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Engineering and Mining Journal

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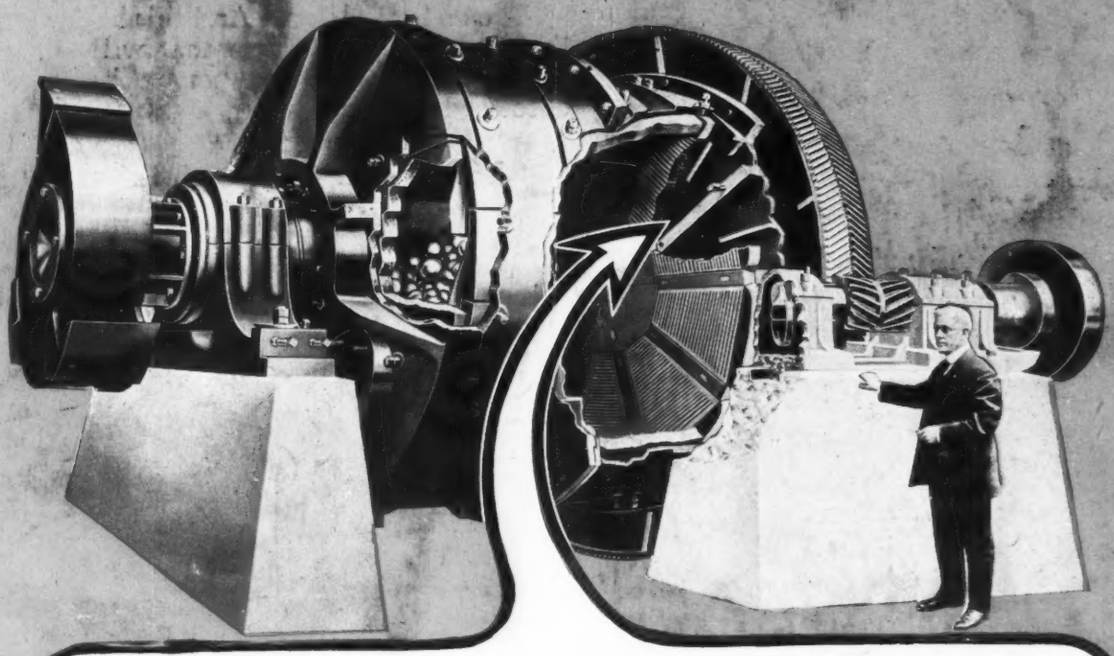

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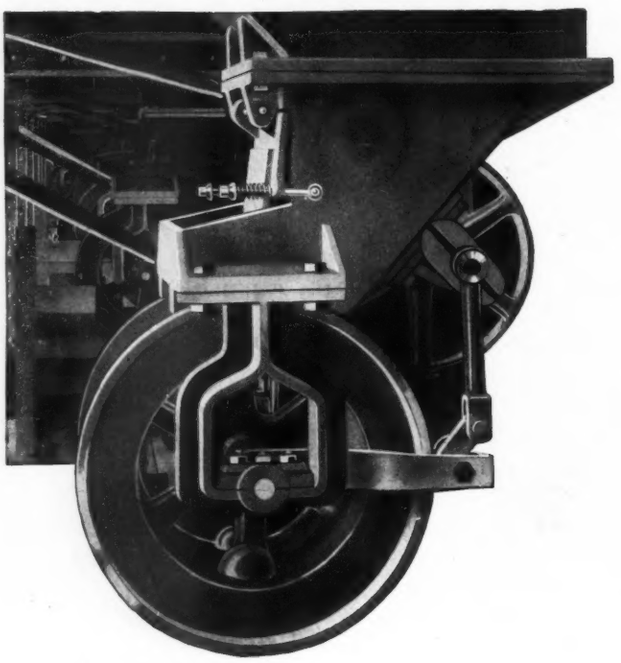

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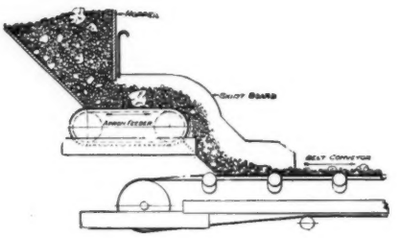

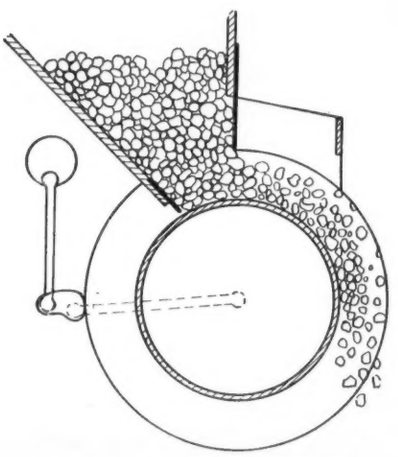

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PORTAL OF AKRON TUNNEL, WHITEPINE TOMICHI DISTRICT, COLORADO

The Whitepine Section of the Tomichi District

BY JAMES E. DICK*

The Gunnison County, Colo., mining district was first prospected in 1879, and has produced silver and lead carbonate ores from shallow depths. A 3750-ft. tunnel has been driven, and the mines of the district have been consolidated. Ore developed shows lead, zinc, copper and silver sulphides containing certain amounts of gold. Orebodies are replacements along fault fissures in intruded sedimentaries, and recent developments bid fair to revive interest in this field.

THE Whitepine mines are in the southern section of the Tomichi mining district and are situated near the eastern boundary of Gunnison County, Colo. The town of Whitepine lies 11.5 miles north of Sargent, a station on the Marshall Pass division of the Denver & Rio Grande R.R. and the shipping point for the district. The elevation of Whitepine is 10,000 ft. and that of Sargent 8500 ft. above sea level. The district lies on the western slope of the continental divide in a country of rugged topography.

The first discoveries in the Tomichi mining district were made in the Whitepine section in 1879, and until 1893 a large production of silver and lead came from the carbonate deposits at and near the surface. Litigation, and the appearance with depth of increasing quantities of zinc and heavy flows of water, and finally the demonitization of silver, discouraged the miners and brought about an almost complete abandonment of the field. Occasional attempts to work the abandoned mines followed, but without notable success. From 1900 to 1905 the Akron tunnel was driven 3750 ft. into Lake Hill, but it never reached its objective and the work was discontinued. In 1913 the continuation of the Akron tunnel was undertaken, and since then the consolidation and exploration of the most promising of the properties have been proceeding under the name of the Akron Mines.

Whitepine includes a sedimentary area roughly one

*Agent, Akron Mines, Whitepine, Colorado.

by three miles, bordered on the north, east and south by granite and on the west by quartz monzonite. The mineralized area is confined largely to these sedimentaries, though at least two fissure veins of importance are known to exist in the granite.

With the possible exception of a small quantity of pre-Cambrian quartzite, the sedimentaries are of Paleozoic age and embrace the Cambrian, Ordivician, Devonian, Mississippian and Lower Pennsylvanian beds, which form a syncline resting on pre-Cambrian granite. The principal mineralized area is along the west side of the syncline, and there the beds dip toward the east at angles ranging from 40 to 60 degrees.

There are numerous minor faults, and at least two that are large and extensive, namely, the Morning Glim and the Star. The former, a reverse fault, strikes northwest and southeast and cuts off the sedimentary area on the northeast. The throw exceeds the thickness of the Paleozoic rocks, which have been completely eroded from the upper portion, exposing the pre-Cambrian granite. This fault can be traced for a distance of 2¼ miles.

The Star fault strikes roughly north-south, through the west-central part of the district, and dips to the east with the stratification. It is likewise a reverse fault and shows a vertical displacement approximating 2000 ft. The granite at this point has also been faulted and elevated to the lead of the sediments, and where exposed at the surface there is a complete repetition of the entire series again dipping into the hill. The fault can be traced for a mile and may or may not intersect the Morning Glim fault in the northern corner of the area. It has been the most productive fault of the district, and from it came the ore of the May-Mazeppa, Morning Star and Victor mines.

Veins and Faults Are Numerous and Complicated

The North Star fault, somewhat less prominent, crosses the district in a northeast-southwest direction and intersects both the Star and Morning Glim faults. Its dip is to the northwest. Minor faults are frequent and occur at least in two distinct sets or systems. The fault and vein systems, however, are as yet not thoroughly worked out, and therefore complete information is not available. Sufficient work, however, has been done to demonstrate that veins and faults are numerous and that a complicated condition exists in this respect.

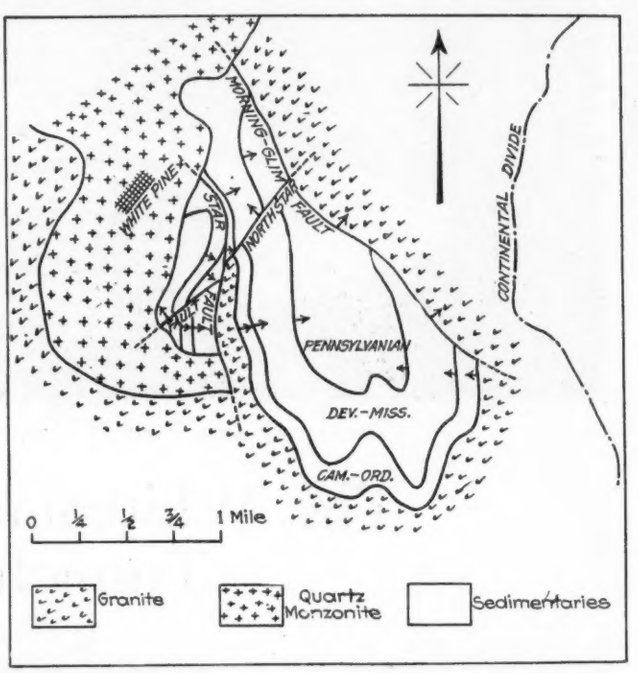
Porphyry dikes have been intruded into the sedimentaries in many places. In most instances the intrusion is a rhyolite-porphyry and is fringed, where it comes in contact with the limestone, with 6 to 18 in. of pitchstone. These dikes usually conform to the bedding and often follow along the veins.

Replacement Deposits Found Along Fault Fissures

The orebodies are replacement deposits and are found along the larger fault planes and in veins, which have walls of limestone and quartzite, porphyry and limestone, and porphyry and granite. The latter two combinations are more likely to be the walls of orebodies in the larger faults, whereas limestone and quartzite are often the walls of veins other than the main faults. Intersections of veins or faults, or of both, are most favorable for ore. It has also been noted that the ore forms in sags in the strata, and that the proximity of porphyry seems to have had an important genetic influence. One pronounced feature of the deposits is that, though comparatively small in cross section, they have remarkable continuity vertically to all depths so far obtained.

Carbonate ores change to sulphide at less than 300 ft., but oxidation of the wall rocks and vein matter is still in evidence at 700 ft. The depth of the ground-water level is about that of the carbonate zone. Secondary enrichment of the sulphide ore shows at all depths where it has been exposed. The silver content of the ore decreases with depth, whereas that of zinc increases rapidly. There is also a gradual slight increase in the quantity of gold. The lead appears to remain fairly constant.

The North Star and May-Mazeppa (Lost Contact) mines are reached through the Akron tunnel, which has now been driven over 4000 ft. into Lake Hill, and, though the principal work up to the present has been



GEOLOGICAL SKETCH MAP OF WHITE PINE MINING DISTRICT, COLORADO

in development, some production has resulted and a stope has been opened on the North Star orebody. In the last half of 1917, 1800 tons of crude ore was shipped from this stope, and returned an average metal content of 0.03 oz. Au, 6.5 oz. Ag, 18% Pb, and 24% Zn. Considerable second-grade ore was concentrated. An inclined raise has been driven 500 ft. on the vein, and levels have been started at 100-ft. intervals, but the levels are not yet far enough advanced to make it possible to judge the size or shape of this oreshoot. It is exposed on four of the five levels, as well as on the tunnel level.

The Lost Contact vein is likewise opened by an inclined raise from the Akron tunnel workings. The raise is not in the vein, but has been connected by three crosscuts from this raise, and two levels have been extended along the vein for a distance of approximately 150 ft. each. Also, a drift along the vein at the tunnel level has been driven over 250 ft. This work indicates a continuous oreshoot above the tunnel level of an

average grade of 0.03 oz. Au, 10 oz. Ag, 12% Pb, and 14% Zn. The Lost Contact vein is in reality the northward extension of the Star fault, and the oreshoot occurs at a point where a dike of rhyolite-porphyry has been intruded into the fault. The porphyry forms the hanging wall and the underlying limestone makes the foot wall for the ore. The highest point at which the ore has been exposed is 375 ft. above the Akron tunnel, or 200 ft. (measured on the vein) below the surface. At this elevation the ore is still unoxidized.

Ores Show Lead, Zinc, Copper, Silver and Gold

The Erie mine lies 1000 ft. ahead of the Akron tunnel and is being worked through a 280-ft. shaft. This shaft penetrates the sulphide zone for about 100 ft., and levels have exposed an oreshoot of workable dimensions and milling grade. A typical assay will give 0.04 oz. Au, 3 oz. Ag, 14% Pb, and 17% Zn. The ore differs from any other in the district in that it is extremely hard. Extensive stopes of low-grade carbonate have been taken out. The deposit has the appearance of being a more tabular form of orebody than is generally seen in the district.

The Spar Copper group and Ensign claim are reached through the Parole tunnel, which is 2000 ft. long. It is a crosscut tunnel for 700 ft. and follows the vein for the rest of the distance. The Spar Copper is the only mine now in operation which shows ore in a vein. The vein is a fissure in the granite, and strikes across the country in a northeast-southwest direction. It stands almost vertical. Frequent lenses of high-grade copper-silver ore are found connected by stringers and seams of the same ore. The vein material, mined as a whole, makes a good grade of milling ore, which concentrates readily to a product containing 30 to 40 oz. Ag, and 5.5 to 6% Cu. The principal valuable minerals are cupriferous pyrite, chalcopyrite, and chalcocite, all carrying silver, and the gangue mineral is mainly quartz, with occasional small quantities of barite.

In the Ensign claim, at the intersection of the Spar Copper vein and Morning Glim fault, there is a shoot of lead-zinc-copper-silver ore. Nothing has been done to determine its extent, but at the point where cut it has a cross section 26 by 40 ft. There is also a body of copper-silver ore on the claim, from which in 1917 about 1000 tons, of an average grade of 3 oz. Au and 6% Cu, was shipped. The copper is present as malachite and chalcocite in a mass of limonite. The exact geological conditions bearing on this occurrence are not entirely obvious, but the walls are limestone and quartzite, and it is believed to be another intersection deposit in the Morning Glim fault.

The Morning Star mine is now idle. It has been worked to a depth of 400 ft. and has reached water level. A long drift is being driven, by lessees, from the Morning Star tunnel under the Victor claim, with the purpose of undercutting the oreshoots which were worked so successfully in the Victor mine in the early days of the district.

The exploration work of the last four years indicates strongly that bodies of ore of commercial value exist along the western side of the district, and that these bodies may be expected to occur at fairly frequent intervals. It further indicates that this ore forms in shoots of comparatively small horizontal extent and of persistence with depth, and that the shoots come at certain well-established horizons and usually under a known set of conditions. Because of these facts, exploration work can be conducted along scientific lines and with generally satisfactory results.

Better Power and Transportation Facilities Needed Properly to Develop District

The elevation and climate are similar to those of many Colorado mining camps and present no serious problems. Nor does there appear to be anything unusual in the metallurgy of the ore. However, the greatest obstacle to the development of the district is its present isolation, both as to transportation and power facilities. But neither of these conditions is an insurmountable difficulty, and in due time, and as conditions warrant, the needed transit and power will no doubt be provided.

Development of ore is in progress, and the various operating problems are being solved. With sufficient ore assured and the necessary improvements in mining, milling and transportation methods, there is no reason why this old, abandoned mining district should not again contribute to Colorado's production of lead, zinc, copper and silver. Past production, as shown by mint reports and old records and settlement sheets, makes a creditable showing and gives much encouragement as to what may be hoped for from the sulphide zone.

Electrolytic Iron Manufacture In France by the Burgess Process*

The Société des Aciéries, of Firminy, France, in order to overcome the difficulty, during the war, of obtaining, for the manufacture of steel, an iron as pure as Swedish iron, has started the manufacture of electrolytic iron at its Rioupéroux shops. Several tons have already been obtained, and the installation of a plant of a capacity of 25 tons per day is under way. The process employed is that invented by Professor Burgess, an American, who first began experimenting with electrolytic iron in 1904. The method is characterized by the use of an electrolyte which does not alter in composition for a long time, nor does it require additions or complicated chemical control.

The electrolyte is a mixture of ferrous sulphate and chloride, and ammonium sulphate, and the process requires that the materials utilized be already pure. The elimination of continuous circulation of the electrolyte, a current density of one ampere per 100 sq.cm., and a temperature as low as 30°, but better at 60° C., have been found to be satisfactory conditions for deposition. The cost of producing the electrolytic iron is expected not to exceed $10 per ton. The following is an analysis representing a lot of a few tons: Carbon, 0.015 to 0.064%; silicon, 0.004 to 0.020%; phosphorus, 0.002 to 0.009%; sulphur, 0.001 to 0.007%; manganese, traces.

Aimé Coutagne, the engineer of the company, has published[1] an interesting study of the process, and has compared it with the methods used by Cowper, Cowles, Merck, Fisher, the Langbein and Pfanhauser-Werke and the Boucher-Société le Fer.

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*Translated from "Texte de L'Echo des Mines et de la Metallurgie," April 28, 1918.

1"Bulletin de la Société de l'Industrie Minérale."

A New Method of Estimating Zinc In Zinc Dust

By L. A. WILSON*

A brief résumé of previous work in estimating zinc in zinc dust is given, but the object of the paper is to present a method that will render the analysis simple, accurate and rapid. Although similar to that ordinarily used in the hydrogen evolution method, the importance of maintaining solutions saturated with hydrogen and minimizing temperature variations is emphasized. The arrangement eliminates sources of error inherent with previously proposed apparatus and decreases the time required for analysis. A drawing is included to illustrate this arrangement.

ZINC DUST, or "blue powder," as it is commonly known, is being used in constantly increasing amounts for organic reductions, sherardizing, precipitation of gold and silver in cyanide practice, and in certain classes of paint. Owing to the demands of the trade for a material superior to the ordinary spelter furnace blue powder, the zinc dust sold today is largely a specially prepared product. The two particular qualities usually demanded by the consumers of zinc dust are fineness and high metallic zinc content. The fineness is best determined by microscopical examination, but as usually carried out in practice it is a simple matter of carefully sieving a sample through a nest of screens. On the other hand, the determination of the metallic zinc content, or reducing power as metallic zinc, is not so easily obtained; and determinations by different methods, or even with the same method by different analysts, show considerable variations. There is need for a standard method which will obviate the misunderstanding originating from variant analyses.

The method and apparatus to be described in this paper are the outcome of experimental work extending over several years, starting with the apparatus proposed by Franz Meyer and adding improvements and modifications as the work progressed.

Résumé of Methods Proposed

Practically all previous methods of analysis are based upon the reducing power of the zinc dust. This may be determined in many ways, although the results from different methods will not be concordant. Fresenius dissolved the zinc dust in dilute sulphuric acid, and, after drying, passed the hydrogen over heated copper oxide in a combustion tube, absorbing the water formed in a U-tube and weighing. This method is accurate, but long and tedious.

Drewsen used a known quantity of standard potassium-chromate solution for reduction by the zinc dust. The excess of chromate solution was titrated with ferrous sulphate, and the metallic zinc content was calculated from the amount of chromate reduced.

De Koninck found that ferric ammonium sulphate accelerates the reduction of chromate. He used a potassium-dichromate solution rather than one of the normal chromate.

Wahl gave a rapid method for evaluating zinc dust, based upon the reduction of neutral ferric sulphate in solution. The resulting ferrous sulphate was titrated with potassium permanganate and the percentage of metallic zinc calculated.

Beilstein and Jawein carried out the evaluation by conducting the hydrogen, resulting from the reaction of the zinc dust and dilute sulphuric acid, into a flask filled with water and measuring the amount of the latter displaced.

Kosmann and Liebschutz carried out determinations by moistening the sample of zinc dust with alcohol, and adding a warm neutral solution of copper sulphate. The mixture was slightly acidified, the copper separated, washed, dissolved, and determined.

Morse made determinations of the metallic zinc content by measuring the hydrogen gas evolved with acid in a eudiometer.

Topf used a weighed quantity of iodine to oxidize the metallic zinc in the zinc dust and then titrated back the excess of iodine.

Barnes also used the volume of hydrogen gas liberated, devising a special apparatus for its measurement.

Weil made determinations by treating the zinc dust sample with cupric-chloride solution and titrating the excess copper with stannous-chloride solution.

Klemp has worked out a method of determining the metallic zinc content of zinc dusts by reduction of potassium iodate in alkaline solution.

Fraenkel modified Drewsen's method by adding potassium iodide to the solution containing the excess of bichromate remaining after the reaction with the zinc dust, and titrating the liberated iodine with standard sodium thiosulphate.

Besides the apparatus of Morse and Barnes for the volumetric determination of zinc dust, there have been many others. The best of these is that proposed by Franz Meyer. This apparatus has been widely used and with proper precautions excellent results may be obtained.

De Koninck and Grandy made comparative investigations of the several methods proposed up to 1902 and concluded that the gasometric determination of the hydrogen evolved gave the most precise results. More recently Sharwood and Herz have proposed using the precipitation of silver from a solution of silver cyanide in potassium cyanide as a means of evaluating zinc dusts.

From the brief outlines of the methods given, it will be seen that they may be grouped into three classes, and that a discussion of inherent errors and accuracy in any one method is also generally applicable to the class in which that method belongs.

1. *The Reduction of a Known Amount of Oxidizing*

*Abstracted from a paper presented at the 21st annual meeting of the American Society for Testing Materials.

Agent—The bichromate method is simple and rapid. The reduction proceeds, theoretically, without evolution of hydrogen gas, but this is probably not always true in practice. It frequently happens that particles of zinc dust will be seen floating on top of the solution with bubbles of hydrogen attached. The reaction with the acid in the solution is an inherent error in this method. The tendency is to get low results, since the reaction of the zinc dust with acid results in less bichromate being reduced.

The volumes of standard solutions used in carrying out the bichromate method are relatively small, compared with the volume of hydrogen gas which the same weight of zinc dust would liberate. The accuracy required in standardizing, reading of burettes, and determining the end point on titration is of a much higher order than that required in the hydrogen evolution method.

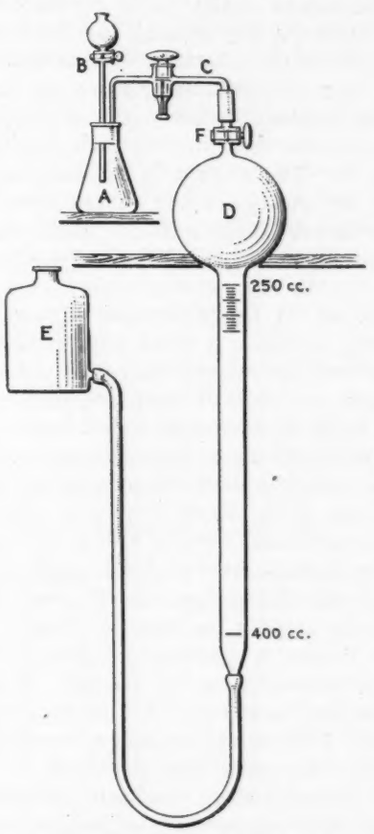
The ferric sulphate method is based on the reduction of the oxidizing agent, ferric sulphate, in neutral solution. The ferric sulphate requires careful preparation for this work. The reduction theoretically proceeds without evolution of hydrogen gas. The results obtained by this method are lower than those obtained by the hydrogen evolution method. The only explanation for this difference is the possible hydrolysis of the ferric sulphate and the reaction of the zinc dust with the small amount of sulphuric acid formed. In this case the hydrogen liberated would not be visible, but would remain dissolved.

2. *The Precipitation From Solution of a Metal With Lower Solution Pressure Than Zinc, i.e., Lower in the Electropotential Series Than Zinc*—The precipitation of a metal from a solution, e.g. copper or silver, by zinc dust does not give the metallic zinc content of the precipitant, but merely an empirical result influenced by many factors. The three most important of these are the fineness of the zinc dust, the kind and condition of the solution, and the equilibrium that is reached between the metal and the zinc with their respective ion concentrations in solution. It is obvious that when a particle of zinc dust becomes completely coated with the precipitated metal, it cannot throw out more of the latter. For this reason the method using the precipitation of silver from a solution of silver cyanide in potassium cyanide is not to be considered as a method for actually determining the metallic zinc content of zinc dust, although it may give an indication of its so-called "precipitation efficiency," as applied in cyanide practice.

3. *The Solution of the Zinc Dust With Acid and the Measurement of the Volume of Hydrogen Liberated*—The hydrogen evolution method is the one most used by responsible analysts. It is based on measuring the volume of hydrogen gas evolved from the action of zinc dust on pure dilute sulphuric acid. This volume is then calculated to standard conditions (correcting for the vapor tension of water). The percentage of metallic zinc is determined, on the basis that, at standard conditions, one gram of pure zinc liberates 342.5 cc. of hydrogen.

The Franz Meyer apparatus has the disadvantage of generating the hydrogen gas adjacent to the outlet for the liquid being displaced. Consequently, small bubbles of hydrogen and often small particles of zinc dust are carried out with the displaced liquid. However, both of these causes for error may be eliminated by inserting a relatively large glass tube between the apparatus and the leveling bottle. The Meyer apparatus has also the other disadvantage of being slow in operation.

The use of a factor to correct for the solubility of hydrogen in water and acid is not entirely satisfactory, even though determined with c. p. zinc. The solubility of hydrogen is affected by temperature, and the factor must include a temperature correction. Furthermore, the volume of liquid in contact with hydrogen long enough to become saturated is not the same in any two tests. Errors from this source can be avoided by starting with all solutions saturated with hydrogen and maintaining nearly constant temperature.



ZINC-DUST TESTING APPARATUS

Experience with these three types of methods on all grades of zinc dust and granulated c. p. zinc has proved that the hydrogen evolution method will give more accurate results than any other method recommended. This more than compensates for the longer time required for making the determination.

The procedure and apparatus recommended are fundamentally the same as in the Franz Meyer method, but accuracy has been insured and the time required materially shortened.

The method and apparatus will be understood by reference to the diagram. A 1-gm. sample of zinc dust is weighed and transferred as rapidly as possible to a small Erlenmeyer flask *A*, of 100- or 200-cc. capacity, in which is placed a piece of sheet platinum about 1.5 cm. square. About 5 gm. of clean unoxidized ferrous sulphate crystals are added on top of the zinc dust, and the flask is nearly filled with distilled water saturated at room tem-

perature with hydrogen gas. The object of adding the sheet platinum and ferrous sulphate is to increase the rate of hydrogen evolution by catalytic action. A further reason for adding the ferrous sulphate on top of the zinc dust sample is to coagulate the latter as much as possible when it becomes wetted, and thus prevent the floating of more than an unappreciable amount.

The rubber stopper containing separatory funnel *B* and connecting tube *C* is tightly inserted into the neck of the flask. A little distilled water is poured into *B* and the three-way stopcock in *C* turned to connect the flask with the downward outlet. Enough water is now run in from the separatory funnel to displace all the air in the flask and the connecting tube through the bore in its stopcock. The stopcock in *C* is now turned so that the downward outlet is in connection with the measuring tube *D*. By raising the leveling bottle *E*, containing 10% sulphuric acid, also saturated with hydrogen at room temperature, all the gas in *D* is displaced. The stopcock in *C* is now turned through 90°, so as to connect the decomposing flask *A* with the measuring tube *D*. The system is hence completely filled with liquid and ready for the generation of hydrogen. The measuring tube *D* has a total capacity of 400 cc. and is graduated from 250 to 400 cc. by 0.25 cubic centimeters.

Thirty cc. of 1:1 sulphuric acid is now poured into the separatory funnel. A small part of this acid is allowed to run into the decomposing flask until a brisk but not too rapid evolution of hydrogen takes place. The acid, being much heavier than water, settles to the bottom of the flask and the action begins immediately. The gas evolved, together with some solution and a small amount of zinc dust, passes over into the measuring tube, displacing the acid there. When the action in the decomposing flask has slowed down, more strong acid is introduced, until all has been added. During this time the acid in the measuring tube and flask is shaken so as to wash down the particles of zinc dust from the upper parts of the flask and tube now filled with gas. The particles in the measuring tube on coming in contact with the 10% sulphuric acid are readily dissolved and generate their portion of hydrogen.

When all the zinc dust has been dissolved, water is run in from the separatory funnel to force the hydrogen over into the measuring tube and to fill the flask and connecting tube with water through to the stopcock *F*, which is then closed. After leveling with the leveling bottle, the volume of hydrogen generated from the 1-gm. sample at the prevailing atmospheric conditions is read from the measuring tube. The percentage of metallic zinc in the sample is then calculated from the following expression:

$$\textit{Per cent. of metallic zinc} = \frac{V \times (P - p) \times 0.29196}{(1 + 0.00367t)760}$$

in which V = volume of gas in measuring tube at atmospheric conditions, P = barometric pressure, p = vapor tension of water above 10% sulphuric acid at room temperature, and t = room temperature.

To obtain accurate results it is necessary, when weighing out samples of zinc dust which are finely divided, to minimize the oxidation that takes place on exposure to the air. It is also highly important that samples are kept in ground-glass stoppered bottles, completely filled, and sealed with paraffin or wax. The two variables most likely to affect the results are temperature and barometric pressure. A careful estimate of the barometric pressure is necessary. A temperature change affects not only the volume of gas but also the vapor tension of water, and hence the actual pressure on the hydrogen when measured. Unlike barometric variations, changes in temperature can to a large extent be avoided by making the analyses in a room maintained at a nearly constant temperature, enclosing the apparatus in a cabinet with door fronts that are opened only when measurements are to be taken, and keeping all water and acid saturated with hydrogen.

The rubber connection between the connecting and measuring tubes must be of heavy rubber and should be painted with shellac.

Use of Filtros in Centrifugal Washers

By M. H. Merriss*

An interesting problem arises in many copper refineries in connection with nickel recovery, in which process, in most cases, after several preliminary steps, crude anhydrous nickel sulphate is separated out as a yellowish green slimy substance from a mother liquor of concentrated impure sulphuric acid, by boiling in either iron or lead pans. The salt is drained and partly air dried by throwing it up on slanting drain tables, but a large quantity of entrained acid remains with it. A successful apparatus for making this peculiarly difficult washing is the centrifugal extractor manufactured by the Tolhurst Machine Works, of Troy, N. Y., which uses for the filtering medium various combinations of copper or monel-metal screens. It is essential to the process that these screens have fine slotted holes punched in them, but, even with the resistant metals noted, the slots enlarge rapidly and allow the extremely fine nickel sulphate to pass through. This in turn throws the revolving basket out of balance, necessitating frequent repairs, with consequent expense and loss of time, to say nothing of the unsatisfactory separation work done by the screens in the period preceding repairs. Filtros, a siliceous filtering medium, manufactured by the General Filtration Co., has been tried and proved successful from the start. It is, of course, unattacked by acid, the pores do not clog, and yet there is no leakage of the finely divided nickel sulphate, so that the machine never gets out of balance. A set of curved plates of Grade B—1¼ in. thick—is so made as to fit nicely against the side of the Tolhurst basket. Filtros can be drilled easily, although it dulls the drills badly, and can be cut with a hacksaw, so there is no trouble in putting it in. Then a piece of monel-metal heavy wire screening, with through bolts and strap washers, is put in to hold the plates snugly. For caulking material, asbestos wicking is used. The manufacturers' Grade C —¾ in. thick—is probably even better, taking up less space as well as being lighter. With such an installation, the only repairing necessary is the changing of the through bolts. These can be made of copper, and therefore should be resistant to acid, whereas formerly the screens themselves wore out and had to be changed frequently.

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Construction and Operation of an Electrolytic Copper Refinery*

By J. E. McALLISTER

A detailed description of the probable cost of construction of an electrolytic refinery to handle 50,000 tons of blister copper annually. Economic aspects are discussed, the basis of cost estimate is defined, proposed practice is outlined, and estimated initial and operating expenses are given.

THE investigation which is the subject of this report had for its object the determination of the cost of constructing and operating an electrolytic copper refinery in the Niagara Peninsula of Ontario, having a capacity of 50,000 tons of refined copper per annum. The estimates which follow are based upon the data given under the head of "Basis," and a conclusion is arrived at that the expenditure for constructing a plant of this type would amount to $1,502,800, and the cost of operating the same would be $13.112 per ton (of 2000 lb.) of refined copper produced.

In selecting the location of an industry of this type, the governing considerations are electric energy, temperate climate, fuel and other supplies, and labor conditions. Adequate transportation facilities are a necessity, and a location on tidewater possesses the obvious advantage of facility in receiving supplies by water freights, and in shipping the refined product by the same means. The location of a refinery, however, at or near that of the producing mines does not possess distinct advantage, for the reason that the raw material coming in for refining would undoubtedly be a bessemerized product carrying 99% copper. This could therefore be shipped from the point of smelting to the destination of the refined-copper product under the one freight charge, the product being merely stopped for "refining in transit." In compiling the following report, the services, in a consulting capacity, have been utilized of R. W. Deacon, Superintendent of the United States Metals Refining Co. at Chrome, New Jersey.

Conditions—The refinery is to be equipped to handle 50,000 tons per annum of bessemerized copper (commonly known as blister copper) containing gold and silver, the output consisting of refined copper in the shape of wire bars, cakes or ingots; gold in the form of fine gold bars, and silver as fine silver bars. The value of the precious metal carried by the blister copper will have its bearing on the cost of operation, as, should the gold contents run high, the speed of deposition of the copper must, for economic reasons, be retarded. On this account it is assumed that the blister copper will assay not over 100 oz. of silver or 5 oz. of gold to the ton, these quantities being within the range of the precious metals contained in ordinary blister-copper production. The ground is also taken that the impurities in the blister do not consist of one seriously damaging element, such as arsenic or nickel, but are distributed over the various usual elements. It should be noted that blister copper, aside from the conditions named, would require special treatment.

The present cost of materials and labor in the Niagara Peninsula has, in the main, been used as a basis of calculation, and the following are the chief items which have entered into the same:

Labor—A base rate of 22½c. per hr. on a 10-hr. day for unskilled labor, from which all other rates are scaled.

Power—High-tension alternating-current power delivered at low-tension terminals of transformers at the rate of $15 per horsepower-year.

Structural Steel—Fabricated and delivered f.o.b. plant, 5.5c. per pound.

Copper—Rated at a quotation of 20c. per lb. for electrolytic wire bars.

Antimony Lead—Per lb., delivered, 13.5 cents.

Building Brick—Per M. delivered, $13.

Siliceous Refractory Brick—Per M. delivered, $30.

Machinery—Prices prevailing at the present time (March, 1916.)

Bituminous Coal—Per ton, delivered, $4.

Coke—Per ton, delivered, $4.25.

Cement—Per barrel, delivered, $1.35.

Lumber—Prices prevailing at the present time ($25 to $35 per M., March, 1916).

Plant Arrangement

There is ample territory in the factory district of the Niagara Peninsula for the selection of a suitable site. A ground plan of a refinery of this capacity is given herewith (see plan), and under this arrangement the plant would occupy a space of approximately 22 acres. It is to be noted that the incoming material is delivered to the plant by standard-gage railroad, the fuel to one side and the blister copper to the other. Subsequently the material is handled by an industrial railway system, operated by steam, and of either 24- or 30-in. gage. Following a shipment of blister copper through its various steps on this plan, it would be received over the railroad spur *B*, weighed in the control weighing room *E*, sampled in the sampling room *F*, and then placed in the storage under the craneway *L*, from which it is taken as required to the furnace building *K* and brought up to pitch in reverberatory furnaces, from which it is cast into anodes, the anodes being stored under the craneway *O*. From this storage the anodes are delivered to the tank house *U*, where the electrolytic copper is produced, leaving the tank house in the form of cathodes, and placed in storage under the craneway *O*, from which point it is delivered to the reverberatory refining furnaces *J*, where it is melted and cast into the form required by the consumer.

During the electrolytic action from anode to cathode, slime is formed in the tanks, consisting of the impurities contained in the blister copper, as well as its precious metals, this slime being subsequently treated

*From the first report of the Canadian Munition Resources Commission.

in the department *W*, where the gold and silver are separated and turned out in the form of bars.

A small cupola furnace is added, in which the slags from the reverberatory furnaces are treated, and their valuable metallic contents recovered.

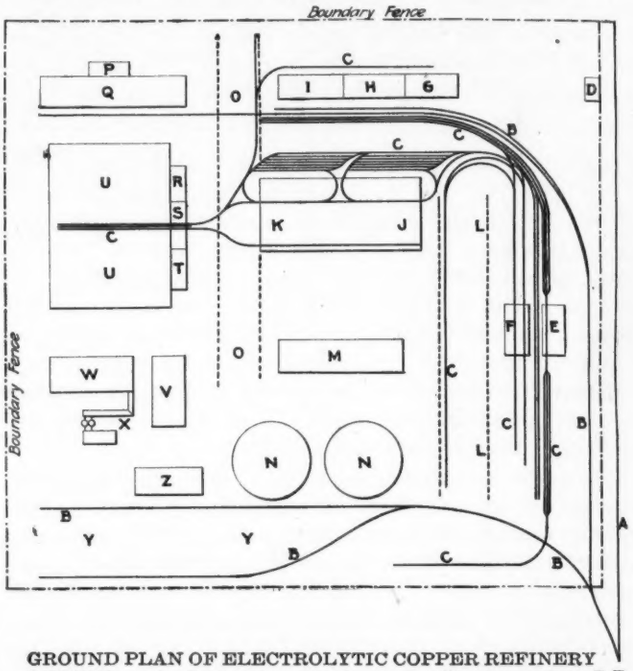
In considering the equipment of the plant, its capacity permits of the installation of modern labor-saving devices in each department. In this connection the cost of installation is governed by the balance which obtains between decreased operating cost and the amortization of construction expenditure incurred to acquire such decrease. Special apparatus should be installed for transferring blister copper from railroad to industrial cars, and refined copper from industrial to railroad cars. In the scale house *E*, tandem scales would be installed for control weighing of the blister, one scale checking the other. The accuracy of these scales is of first importance and would be aided by their capacity being considerably in excess of the ordinary load. In this case the copper would probably be weighed in quantities of five tons, and the capacity of the scales should therefore be not less than 12 tons, or double the weight of the industrial railway car with its load. After weighing, the blister copper proceeds to the sampling room, where it is sampled by drilling a ½-in. hole through each cake, for which purpose an ordinary drill press is used. After sampling, the blister copper is stored in the yard *L*, whence it proceeds to the anode furnace. It is necessary to maintain a sufficient quantity of sampled raw material in storage to permit of the continuous operation of the anode furnaces.

The furnace building *JK* should be of steel construction, containing at one end two anode furnaces for melting the blister; and, at the other, two refined-copper furnaces for melting and converting the cathode copper into merchantable form. Each anode unit would consist of a reveratory furnace lined with siliceous refractory brick and having a 24-hr. capacity of 100 tons. The furnace would be fired by slack coal and be fitted with a waste-heat boiler to conserve the heat for maintaining the necessary temperature required by operations in other buildings, this boiler being also equipped for auxiliary firing for use when the furnace is not in operation, thus saving a separate boiler installation. The raw material would be charged into the furnace on one side from the industrial railway by means of a charging crane, and the molten copper automatically tapped from the other into anode molds, the furnace being served at this side by a Walker casting wheel and a 10-ton traveling crane.

The depth of the bath of molten metal for a furnace of this type would be from 21 to 24 in., and a cycle of its operation throughout the 24-hr. period would consist of:

	Hours
Charging	1½
Melting down	9
Refining and poling	7
Casting	6½
Total	24

A sufficient storage of coal fuel should be carried to cover two months' operations of both the anode and refined-copper furnaces. It is necessary to maintain an excess of anodes in storage in order to feed the tank house, and for this purpose a storage yard is provided between the furnace house and the tank house. In this same storage is also held the cathode copper as delivered from the tank house for melting in the refined-copper furnaces, of which there are two, each being a duplicate of the reverberatory anode furnace, with the same capacity and equipped in the same manner with waste heat boilers, charging crane, and Walker casting wheel. The tank house building should be a steel structure with either brick-filled or concrete walls, and a fireproof heat insulating roof, and should be laid out in two bays hous-



GROUND PLAN OF ELECTROLYTIC COPPER REFINERY

LEGEND: A, Railroad, main line. B, Standard gage R.R. tracks in plant. C, Industrial railway—principal tracks. D, Time clock, office and plant entrance. E, Control weighing room. F, Sampling room. G, Office. H, Laboratory. I, Warehouse. J, Furnace building, refined copper end. K, Furnace building anode end. L, Storage craneway for refined and blister copper. M, Machine and repair shop. N, Bosh water reservoirs. O, Storage craneway for anodes and cathodes. P, Transformer house. Q, Power house. R, Circulating system pump room. S, Anode and cathode weighing scales. T, Tank-house heating plant. U, Tank house. V, Regeneration plant. W, Slimes refinery. X, Slimes refinery flue system. Y, Coal and coke storage. Z, Cupola furnace building for slag reclamation, etc.

ing 512 tanks, arranged into 16 sections of 32 tanks each, or 8 sections to each bay with a separate electrolytic circuit.

The circulation and heating systems are housed in annexes, and each bay should be provided with two 10-ton traveling cranes. The anodes would be lifted from the storage *O* by "finger" crane hooks in batches of about 30, placed in rack cars, transported by the industrial railroad to the tank house, and unloaded by traveling crane, which would also deposit each anode to its allotted space in the tanks. Scales for interdepartment accounting are provided to weigh the incoming anodes and outgoing cathodes from the tank house.

The power house would be of steel frame, with brick fill or concrete wall, and equipped with a hand-power traveling crane to facilitate the handling of parts for repairs. In it would be installed five electrolytic units, each consisting of a motor generator set designed to give a constant current of 5000 amperes at a varying voltage of from 60 to 115, four of these being arranged to work in groups of two in parallel, directly to the two separate circuits in the tank house. The fifth would be connected to act as a spare for any of the others.

All the plant in the power house would be motor driven, and in addition to the above units it would contain bosh pumps, general service pumps, hydraulic pumps, fire pumps, motor generator set to supply d.c. electric current to cranes, high pressure air compressors for the operating of handling devices and other necessary apparatus.

The slime carrying the precious metals is transferred from the tank house to the slime refinery, the latter being equipped with steel tanks, boiling tanks, filter press, roaster, reverberatory furnace for production of doré bar, silver melting furnace, and gold crucible furnace. These three furnaces would be connected to an outside collecting flue system. The department also contains a motor generator set operating on 36 cells for the electrolytic parting of silver from gold; gold refining pots, bullion balance, and safety deposit vault for the storage of doré, fine silver and gold.

Construction Costs

Costs are segregated by departments, and also into the various units that go to make up the same, and would be as follows:

Furnace building	$ 67,500	
Two anode units	95,500	
Two refined-copper units	92,200	
Four cranes, two service, two charging	40,600	
Auxiliary equipment	84,800	
Total furnace department		$380,600
Tank house building	$127,000	
Sixteen 32-tank sections and circulation system and equipment	258,000	
Electrolytic circuit conductors, etc.	96,000	
Four service cranes	25,000	
Auxiliary apparatus	51,000	
Total tank house department		557,000
Power house building and crane	$ 42,000	
Five electrolytic motor generator sets and equipment	116,000	
Motor driven pumps, etc	32.200	
Auxiliary apparatus	30,200	
Total power house department		220,400
Slime refinery building	$ 38,000	
Settling and boiling tanks, filter press and roaster	16,500	
Furnace and flue system	22,100	
Electrolytic parting cells and equipment	18,800	
Gold-refining equipment	2,600	
Auxiliary apparatus	11,700	
Total slime-refining department		109,700
Shops building and equipment	$ 31,000	
Office and laboratory and warehouse equipment	44,000	
Sampling apparatus	7,500	
Control weighing scales and housing	7.400	
Storage cranes, craneways and locomotive crane	36.700	
Receiving and shipping apparatus	3.600	
Industrial locomotives and cars	47,800	
Industrial tracks and railroad sidings	24,500	
Miscellaneous auxiliary apparatus	7,600	
Bluestone and acid necessary to make up electrolyte	25,000	
Total miscellaneous		235,100
Total		$1,502,800

In addition, there should be the emergency department, consisting of repair shops, machine, blacksmith, and carpenter shops, and like equipment; also a warehouse for supplies, a plant office, and a laboratory equipped for the accurate control of assays and determination of the various products of the different stages of operation. The equipment should also include a locomotive crane for the handling of fuel from the storage and for other miscellaneous requirements.

The plant should also be properly fenced, the operatives being passed by an attendant, both in coming in and going out. In this connection it is necessary to provide the slime refinery with suitable accommodation so that operatives may change their clothing before entering and after leaving.

The raw material handled by the plant will be almost entirely in the form of blister copper, consisting of cakes about 30 in. long by 20 in. wide and 3 in. thick. Its quantity and value are determined by the scale house, sampling room, and laboratory. It is first weighed and then sampled by drilling a ½-in. hole entirely through each slab. An ordinary drill press will be used for this purpose, and the slabs drilled alternately from top and bottom by the so-called checker-board method. The location of the hole drilled in each slab will be governed by a templet covering the entire surface of the slab, and having a ½-in. hole in the center of each square inch. The holes in the templet are numbered and used in consecutive rotation, and templets are provided for both top and bottom surfaces of the slabs. The drillings from each shipping lot are put through a grinding machine, and the quantity is reduced by means of a splitting machine to about 5 lb. in weight, which constitutes the sample. This should be ground and reground until all passes through a 16-mesh sieve. If the blister copper contains appreciable quantities of precious metals, the sample should subsequently be sifted through a 40-mesh sieve, and the coarse material and fines kept separate, in order to insure accuracy of the determination, as the precious metals have a tendency to stay with the larger particles.

Metal Losses

In the manipulation of the various steps of refining the copper, there will be unavoidable mechanical losses, which, however, will to some extent not be in evidence, as there are corresponding mechanical losses in determining the contents by assay. This is particularly the case where the blister copper contains minute quantities of gold, in which event the unavoidable loss in assaying will sometimes be greater than the proportionate loss in refining, and the gold recovery by the refinery will be more than 100% of the amount as determined by assay. In general, however, it is safe to figure that a plant of this type will operate with a recovery of:

	Per Cent
Copper	99.6
Silver	100.0
Gold	100.0

Two methods of accounting for the incoming copper by the refinery are generally employed. The refinery will either pay for the blister copper, with its contained precious metals, deducting sufficient to cover its metal losses and making a charge for refining, or else it will undertake to return to the shipper refined metals cor-

responding to those contained in the blister copper after deducting its refining charge. In the latter case the refining charge must include the metal losses of the refinery as well as the operating cost and profit.

The tank house must be kept at a uniform temperature of about 80° F., causing a tendency in cold weather to "sweating" on roof and walls, on account of the large amount of moisture evaporated from the electrolytic tanks. For this reason the heating should be preferably by the circulation of dry hot air to absorb the evaporated moisture. The tank solutions must be maintained at a temperature of approximately 150° F., the copper electrolyte consisting of about 4% copper in the form of sulphate, together with about 12% of free acid. During the deposition of the copper, the electrolyte becomes, in course of time, polluted by the impurities contained in the anode copper, on account of which a certain amount of the electrolyte is periodically drawn off and treated in the regenerating plant, the purified solution being returned to the copper electrolytic tanks. The rate of deposition of copper on the cathode will be governed by the current density, which should not amount to more than 20 amperes per sq.ft. of anode surface for copper carrying up to 100 oz. of gold and silver to the ton. Should the amount of precious metals be appreciably less, the current density may be increased up to, say, 30 amperes, thereby increasing the speed of deposition and shortening the time of operation. Should the deposition take place too quickly, there is danger of occluding precious metals with the cathode copper. A cycle of operations in the tanks at the 20-ampere current density would occupy from three to four weeks.

One section of the tank house is devoted to the preparation of cathode starting sheets, for which purpose a copper plate coated on each side with oil or graphite is used as a cathode blank, and a thin layer of copper deposited thereon by electrolysis. This is stripped off from each side and forms the cathode starting sheet. In the routine operation the electrolytic tanks are first charged with anodes, and then hung with cathode starting sheets, and the current is started. It is kept on for a prescribed number of days, varying from 10 to 12; then the cathodes which have been formed on the starting sheets are removed, the solution is lowered in the tanks, the anodes are taken out temporarily, and the slime is removed and sent to the slime refinery. The anodes are then replaced, fresh cathode starting sheets hung, and the current is turned on for another period of 10 to 12 days; then the "pulling" is repeated, except that upon this occasion what is left of the anodes is removed and goes back as scrap to be remelted in the anode furnaces. It will be noted, therefore, that for each anode going to the tanks two cathodes of lighter weight are formed. The theoretical deposition of the copper would be approximately 0.062 lb. of copper per ampere day, and a current efficiency of at least 90% should be acquired. The necessary pressure would be about 0.4 volt per tank, and upon this basis the rate of deposit should amount to about 6 lb. of cathode copper per kilowatt-hour.

The cathodes are weighed on leaving the department, and stored, from which point they are fed to the refined copper furnace for melting into the shape required by the consumer, for example, ingots, wire bars, and cakes.

The precious-metal slime reclaimed from the electrolytic tanks would amount to about 30 tons per month, containing about 440,000 oz. of gold and silver. The slime is first freed of the electrolyte by settling until it contains about 50% moisture. It is then boiled with sulphuric acid to remove soluble copper, after which it is put through a filter press and roasted. This roasted product is combined with a portion of unroasted slime to make up a furnace charge. The result will be the melting of about 20 tons per month of slime containing from 15 to 25% moisture, the melt taking place in a small reverberatory furnace, the product of which is doré bars. These form the anodes for an electrolytic deposition, which takes place in an electrolyte slightly acidified with nitric acid, the silver being deposited on cathode blanks in crystalline form, and the gold settling as a black mud containing about equal quantities of gold and silver. The resulting silver crystals are scraped off the cathode blanks, washed and melted into fine silver bars. The gold mud is purified by treatment with nitric acid to part the gold from the silver, the solution going back to the silver electrolytic tanks, and the gold sand melted with borax into fine gold bars.

It has been pointed out that there should be a storage of blister copper maintained previous to the melting operation for the production of anodes, and also a storage of cathode copper between the tank house and the final resmelting furnace. In addition, there is the time occupied by the operations in the furnace building and the tank building. As a result of this, the time occupied by the plant under consideration between receiving the raw material and obtaining therefrom the metals in refined form would be from 50 to 60 days in the case of the copper, 65 to 75 days for the silver, and 70 to 80 days for the gold. The value of the material, with its consequent interest loss during this elapsed time, must therefore be taken into consideration, either in the refining charge imposed by the plant, or in the form of a deferred date in paying for the incoming blister copper. The latter is the usual method; but the shipper is, on the other hand, entitled to draw upon the refinery, upon presentation of bill of lading, for from 90 to 95% of the value of the shipment by paying the usual bank interest charge for the amount of the draft during the period agreed upon, which would correspond to approximately the elapsed time noted above. It should also be noted that the settlement quotations, in the case of metals of fluctuating value like copper and silver, should be based on the market quotations at the time the refined metals are ready for sale, and not at the time the blister copper is shipped by the consignor. By this means the refinery protects itself from violent fluctuations in the price of copper.

Operating Costs

In compiling the following costs of operation, it is assumed that metal losses, and also interest on payments advanced, will be included in the charges made by the refinery. The costs have been figured in dollars per ton of refined copper on the basis of the unit of production of each department, and finally converted into a total cost for all operations, in each case segregating the amount for labor and material. This would be the manner in which the actual operations of the plant would be recorded in order to control the efficiency of the different departments.

The following operating costs would probably result from the operation of a plant arranged as proposed:

	Labor	Material	Total per ton
Anode making	$1.155	$1.213	$2.368
Electrolytic refining	2.025	2.464	4.489
Refined-copper casting	1.00	1.304	2.404
Slime refining	.463	.461	.924
General expenses	.926	.464	1.390
Int. on investment (5%)	....	1.537	1.537
Totals	$5.669	$7.443 (a)	$13.112

(a) Per ton of refined copper.

In order to indicate the expenditure of the refinery on various items, the above costs may be transposed to the following basis:

Labor	$5.669
Material	1.332
Fuel	1.895
Power	1.301
Overhead	1.378
Interest on investment	1.537
Total	(a) $13.112

(a) Per ton of refined copper.

Supplies

The approximate monthly quantity of supplies used by the plant would be as follows:

Electric power	1,465,000 kw.-hr
Soft Coal	1,750 tons
Coke	140 tons
Fuel oil	10,000 gal.
Sulphuric acid	50 tons
Siliceous brick	39,000 (9 in. equivalent)

Employees

The operations of the plant would require about 350 men, divided in about the following proportions:

Unskilled	110
Semi-skilled	155
Skilled (mechanics, power house men, etc.)	85
Total	350

The figures given do not include executives, clerks or foremen.

Some Legal Decisions on Mine Shaft Accidents

By Chesla C. Sherlock*

The courts have been called upon on several occasions to express an opinion on accidents where miners have been injured by objects falling down mine shafts, and a few recent cases clearly illustrate the law covering the subject.

In an Oklahoma case (Osage Coal and Mining Co. *vs.* Miozvany) it was shown that a miner was working at the bottom of one compartment of a shaft, and while so engaged he was struck on the head and killed by a lump of coal which fell down the shaft after being knocked from the bunting of the tipple by an ascending cage in another compartment. The court found that the evidence tended to show that the lump of coal had been left on the bunting by an overloaded car; and, as this raised a question of negligence, held that it was a matter for the jury. The court also held that it was a question for the jury to determine whether the failure on the part of the defendant to furnish a properly constructed bonnet or other appliance for the protection of the deceased from falling coal amounted to negligence.

In a Missouri case (Ridenour *vs.* Wilcox Mines Co., 164 Mo. App. 576, 1912) the plaintiff's father was a tub-hooker who sustained injuries resulting in his death while working in the bottom of a shaft when struck on the head by a large piece of rock which fell from a can being hoisted in the shaft. The plaintiff alleged that the defendant "carelessly and negligently failed to build or cause to be built a box or continuation of said shaft from the place where it entered into the said underground room or drift to or near the floor of said drift, so that cans ascending from said room or drift would be guided by said box or continuation of said shaft and render said cans less liable to jar against the sides of said shaft and so that any rocks or boulders falling down from said cans would fall straight down." It was contended by the defendant that this petition did not sufficiently show a cause of action, in that it did not show a connection between the defendant's negligence and the death of the plaintiff. The court, however, did not coincide with this view, but held that a cause of action was sufficiently alleged, and allowed a verdict of $2000 in favor of the plaintiff.

In a Michigan case (Maki *vs.* Mohawk Mining Co., 176 Mich., 497, 1913) a trammer in defendant's mine was put to work for the first time as a mucker in one of the mine shafts. While so engaged he was struck and injured by a loaded bucket, which broke away from the wire rope cable by which it was being hoisted. It was shown that the shaft had an incline of 36° and was completed to the 13th level, and at the time of the injury the work had proceeded to the 14th level, or nearly so, the rock taken out being hoisted to the 13th level in buckets. As the loaded bucket started up the shaft, one of the employees took hold of the rim of the bucket with one hand and told another workman to do the same. They then gave their disengaged hands to a third miner, and in this way all three were hoisted with the loaded bucket. After they had passed out of the perpendicular part of the shaft and had entered the part inclining at an angle of 36°, they released their hold on the bucket. It passed up about 10 ft. higher, the cable suddenly parted; and before the plaintiff could get out of the way he was struck by the loaded bucket.

The defendant contended that having furnished a safe cable it was incumbent upon the employees to make inspection of it before using it in any such manner as indicated. But the court held that it was not only the duty of the defendant to furnish a safe cable, but to reasonably inspect it, so that it would remain safe.

In a Kentucky case (Saylor *vs.* Bon Jellico Coal Co., 153 Ky. 474, 1913) the plaintiff was injured while working at the bottom of an airshaft in the defendant's mine by the fall of a piece of rock weighing about 6 lb., which struck him on the head. The court held that it was not only necessary for the plaintiff to allege negligence on the part of the employer and to show facts amounting thereto, but to show that the injury resulted from such negligence. In this case, there was no evidence to show that the injury was due to the negligence of the employer or any of his servants. There was no evidence to show how the rock happened to fall down the shaft or what caused it. The court therefore held for the defendant.

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MAP OF THE RUSSIAN EMPIRE, SHOWING SITUATION OF THE PRINCIPAL MINING AND MINERAL DISTRICTS

A Gasoline-Driven Diamond-Drill Outfit

BY J. M. LONGYEAR, JR.*

Rapid exploration progress was made in the northern Michigan iron-ore district by the use of a gasoline-driven drill. Nearly 7000 ft. of holes were put down, at a total cost of $2.152 per ft. The apparatus used was so designed that minimum time was consumed in moving from hole to hole, being, for moves of 250 ft., only five hours. Operation possible at 20° below.

EARLY in the spring of 1916 I was engaged to organize an exploring company, the chief object of which was to be a rapid proving up of certain lands in the iron district of the Upper Peninsula of Michigan, and the results obtained in the use of gasoline as a motive power in this connection were interesting. It was necessary that the drilling outfit which the company intended to use should provide dispatch in moving from hole to hole, ability to drill to a depth of at least 750 ft., and efficiency of operation in labor and fuel per foot for drilling.

TOO MUCH TIME CONSUMED IN MOVING STEAM-DRIVEN APPARATUS

Upon investigating common types of steam-driven drilling machines, however, it was found that considerable time was required in moving the apparatus. An extended trip to several diamond drill camps showed that the average time necessary to move a steam-driven outfit from one hole to another, from the time the casing was pulled until the crew started to sink again, was two and one-half days. The plan of campaign adopted anticipated putting down several short drill holes, rather than a few big ones, in order to prove up a property, so that, other things be equal, in the event that use was made of the common, steam-driven type of drill, more than half of the time would be consumed in moving.

GASOLINE- AND STEAM-DRIVEN MACHINES BOTH CAPABLE OF DEEP DRILLING

The ability of steam-driven machines to drill to a depth of 750 ft. was also found in the gasoline types, and it was decided to adopt a "BD" drill made by the E. J. Longyear Co. This type uses "E" rods, gives a $1\frac{5}{16}$-in. core and is belt driven, using both steam and gasoline power. The efficiency of operation could be determined only by trial, but it was realized that if the time of moving could be cut in half, the labor cost would be reduced 25% per ft. of hole, and it is well known that for nearly all purposes gasoline is cheaper per unit of power than steam.

All of these things considered, it was decided to try the gasoline drill, although many experienced operators expressed the opinion that its use would be impracticable in the winter, but at least two members of the exploring organization were good automobile mechanics, and it was decided to make the attempt.

Most of the designing was left to the E. J. Longyear Co., of Minneapolis, Minn., and Marquette, Mich., as that concern has built many drills of different types and is well qualified to tackle something new in this line. Further, its manufacturing plant is situated in the same city as the Longyear company's offices, so it was possible for local representatives to watch the progress of construction. The outfit as furnished consisted of two motor-pump units, a churn buck and frame and a belt-driven diamond drill. The motor-pump units were interchangeable, and could be used either to drive the drill or to pump water from a distance to the drill. The motors were 22 hp. Red Wing marine type, four cylinder, four cycle, and were mounted in a special frame. This frame also held a train of gears and a countershaft, which ended in a specially constructed sprocket wheel. This sprocket wheel drove the pump through a friction clutch and chain, and also was provided with an attachment for a universal joint and shaft, by which the churn buck could be operated. The universal joint and shaft were made so as to be detached easily when being moved.

MACHINE USED AS CHURN OR DIAMOND DRILL

The churn buck was a small one, equipped with a connection for another universal joint, through which the power from the shaft was delivered. On the side opposite the motor-pump unit, the churn buck was provided with a belt pulley, through which the diamond drill was operated. The diamond drill was on posts with adjustable braces, and could be pushed back out of the way, or completely removed. In operation, when sand-piping, the diamond drill was entirely removed, but was set into place when the ledge was encountered. For ease in handling the drill rods, the drill was pushed back on the sliding brace while the rods were being hoisted or lowered.

MANNER OF ERECTING AND TEARING DOWN OUTFIT

As first used by the exploring party, the outfit consisted of the apparatus mentioned, with a 12 x 12-ft. platform consisting of loose planks and stringers and a spruce tripod 37 ft. high. Then the motor pump and churn buck were skidded on the platform, lagscrewed into place and connected. Next the tripod was placed on the ground, two poles behind and one in front, and connected. The center was then raised about six feet off the ground, and the forward pole pulled toward the machine by the churn buck, thus raising the tripod. Minor adjustments were completed by hand. Finally, the scaffold holes were nailed to the tripod, the scaffold was laid and the outfit was ready to begin work. In tearing down, the tripod was lowered by hand, using the churn buck to tie to, so that the timbers would not slide away. Then the churn buck and motor pump were disconnected and skidded off the platform, after taking off the lagscrews. After the platform was pried out of the ground, the outfit was ready to move.

The platform was moved first and placed over the position for the next hole while the team went back

*President and general manager, Longyear-Michigan Exploring Co., Marquette, Michigan.

for the machine. When this had been brought up, it was skidded on the platform by the team. While the machine was being lagscrewed and connected, the team brought the rest of the outfit, so that little time was lost in the moving operation. The average time was approximately five hours under these conditions for moves of about 250 feet.

Inadequate Heat Prevented Drill Operation

This outfit was satisfactory in the summer, but as winter drew on it was realized that it would be necessary to provide some sort of shanty around the drill, so the regulation type of knock-down shanty used by most diamond-drill outfits was built, and by means of a sheet-iron stove it was possible to keep warm for about a month, but when the real freezing weather came on, this type of shanty was found to be entirely unsuitable, as the motor could not be kept sufficiently warm to run, and everything became frozen.

Special Inducements to New Crew

About this time a shake-up in the crew occurred, and they all left. They probably realized that the outfit was not one on which it is desirable or comfortable to work in the winter. In hiring the new crew special emphasis was laid on the nature of the work, and assurance was given that the outfit would be placed on a bonus basis in the matter of wages. Finally four men were hired, two of whom had worked on a drill before, but who practically had to be taught all over again. The foreman, however, was more than anxious to cooperate in trying improvements, and most of the subsequent changes must be credited to his invention and persistence.

Substantial Detachable Shanty Built

The first improvement was to build a shanty that would keep the heat in and the cold out, and one which could be moved more easily than the old one. It was constructed on wooden skids, 14 ft. long and 11 ft. apart. On these skids five stringers were fastened, to which the floor was nailed and the machinery lagscrewed. The floor was made of 2-in. hemlock planks covered with tar paper, and 1-in. pine boards over this. The shanty was built of two layers of boards, with tar paper between, and was made detachable. Whereas the old shanty had three sections to a side, the new one has only one section. The floor, roof, each side, the front and the back each forms a separate section, and all are firmly bolted together. With the exception of the maple skids and the hemlock planks on the floor, the shanty is built of spruce and pine, using spruce for the stringers, wall supports and roof joints and pine for the boards to cover them.

Detachable Features Facilitated Movement

All the machinery and tools were placed in the shanty, and a team of horses could easily pull the whole outfit over the snow. The tripod, when taken down, was laid on the roof, as were much of the pipe and drill rods, so that the time of moving was cut down materially. In fact, from the time the casing was pulled until the first length was started down again, was rarely over an hour, all of last winter.

The gasoline pumping station, however, had to be given up when the weather got around 20° below, so a small shanty was built, of the same type as the drill housing, and a five hp. steam boiler and a small duplex Canton pump were placed therein. This outfit could also be hauled around without tearing down. The exhaust steam from the pump was fed into the suction just above the water line and kept the water warm enough to prevent freezing during the entire winter. In order to keep water in the tank at the drill warm, the exhaust water from the water jacket of the gas engine was allowed to fall into the tank.

Frame To Be Substituted for Tripod

Several other little wrinkles were found that helped matters in connection with the work, so that this coming winter no trouble with the outfit is expected. It is planned to dispense with the tripod, and instead to put a frame with four legs on the roof, so that it will not be necessary to tear it down at every move. This frame can be inclosed with canvas, so that the man on the tripod will be able to keep as warm as the man in the shanty. This arrangement will also lessen the chance of freezing in the hose and connections.

COST OF EXPLORATORY DRILLING WITH GASOLINE-DRIVEN MACHINES

Feet Drilled	No. of Holes	Gasoline, Gal.	Gasoline, Cost	Explosives	Diamonds	Labor	Other Expense	Total Expense	Depreciation	Grand Total
6,739¾	69	1,386.5	$302.91	$104.97	$99.45	$8,860.33	$3,652.73	$13,020.39	$1,500.00	$14,520.39
Per ft. of hole..	..	0.206	0.045	.016	.015	1.311	.542	1.930	.222	2.152

The matter of cost is particularly interesting, and I understand that it is far below anything that can be expected on a steam-driven drilling outfit having the same capacity. The costs per foot, especially, were extremely low. The total cost of the entire equipment as now used is $13,311.08. This includes the two motor-pump units, two churn bucks and two diamond drills, one pumping station, nine shanties (drill, bunk, cook, pump, barn, and other necessary structures), all built on the same plan; also all of the tools and paraphernalia needed and the labor which was necessary to build the shanties and other shacks. In fact this is the original price of the complete outfit, counting extra supplies that are kept on hand, and covers all money paid out on the equipment proper.

The machinery itself cost $2970, not counting the pump and boiler. These were bought second hand, and amounted to $95. The cost of the lumber used in building the shanties was $603.11 and the labor necessary to build them amounted to $226.64, which makes the total $829.75 for the nine shanties. The rest of the equipment, which includes all the tools, pipes, drill rods, diamonds, etc., amounts to nearly $9716.33, making a grand total of $13,311.08 expended for equipment.

Total Expense and Costs Per Foot

For purposes of comparison, in costs per foot of hole, two columns of total expense are given in the tabulation above. The first represents merely the total expenditure of money charged to the work; the second represents the same amount, with the addition of a depreciation charge on the outfit of $100 per month, which is less than 10% on the investment in equipment.

The fuel cost of 4½c. per foot of hole is especially

remarkable. The superintendent of a large diamond drill company said that the cost of 25c. per foot of drilling for wood, cut to burn in their boilers, was their lowest fuel cost figure; so naturally any drilling outfit that will cut 20c. per foot from the drilling cost is worth having. The labor charge is also to be noted. It should be remarked that it includes not only the men actually at work on the drill, but the pay of a teamster and the expense of a team all charged to drilling, and the cook's wages are also included. In some of the cedar swamps which the machine traversed two or three men kept ahead of the drill all of the time to cut roads, and this expense is also included. The men actually at work on the drill are paid a bonus per foot figured on the basis that the crew receive $1 for every foot sunk. Thus, the actual labor on the drill costs only $1 per foot of hole, the remaining 31.1c. representing all the additonal labor referred to.

Further Improvements Contemplated

I do not think, by any means, that the machine, apparatus and method are perfect yet, for several improvements are contemplated, but it takes time to try them out, and there is no disposition to interfere with the operation of the drill at present. I do believe, however, that it is better than the old-style steam outfit, which has not been changed since 1885.

Evaluation and Saving of Power Loss In Belt Slippage

One of the easiest power losses to overcome, and that at small expense, is belt slippage; and since belts are used to such a great extent, it is worth while to look into the matter with more thoroughness than has been accorded generally. The extent of the loss of power, and its value in money, through the slipping of one belt, is indicated by means of the accompanying chart, designed by the Cling-Surface Co., of Buffalo, N. Y. A glance at Column D of this chart indicates that the cost of avoidable belt slips per year ranges into the thousands of dollars.

Where steam power is generated and the energy transmitted to the main line shaft by belt, if the latter slips, which it should not do, a part of the coal value is lost in the form of wasted heat. A main belt is merely a "link" connecting the engine with the generator or with the machine direct. In fact, every belt that transmits power is a connecting link, and the efficiency of that link depends largely upon the freedom from slippage and the avoidance of undue strain on the shaft. Slipless, easy-running belts are most effective.

Where all the power passes through a single main drive belt, this is especially important, as each per cent. of slip in such a belt represents an approximate loss of 1 per cent. of the available energy in the coal used.

Roughly, 2 per cent. of the potential power in the driving pulley of the prime mover is represented by "belt creep." This loss is unavoidable, because of the inherent elasticity of the belt. This has been recognized and provided for in the chart, and Column D gives the avoidable money loss. As shown by the broken lines drawn across the chart, if the total belt slip is 6 per cent. (Column A), and the cost of coal is $4 per ton (Column B), run one straight line through these two points and locate its intersection with Column C. From this point draw a line to the tons of coal burned per year (Column E), which is assumed as 1000, and the loss in avoidable belt slip per year, as shown at the intersection of the second broken line and Column D, is $160.

Yearly loss due to belt slip is often considerably greater than $160, for this calculation obviously applied only to one belt—the main belt. If all of the distributing or secondary belts slip equally as much, the annual loss is doubled, tripled or even increased four-fold.

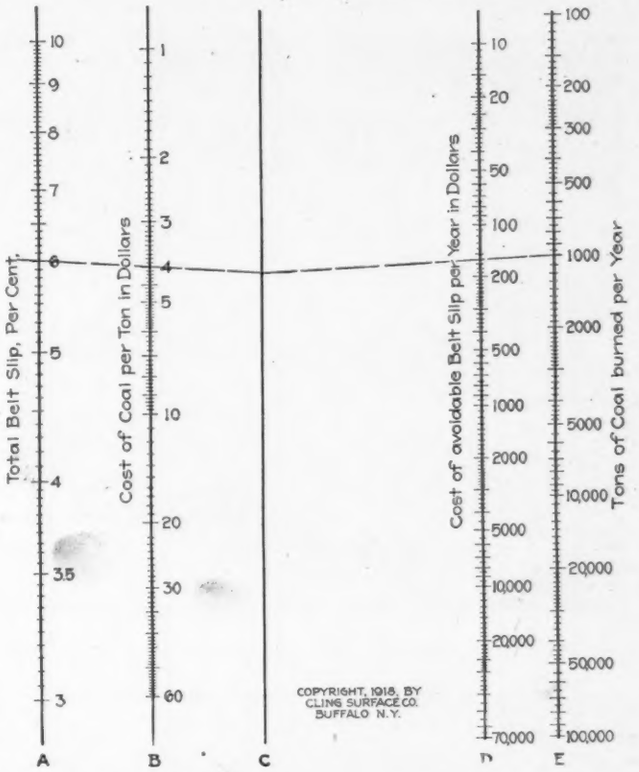
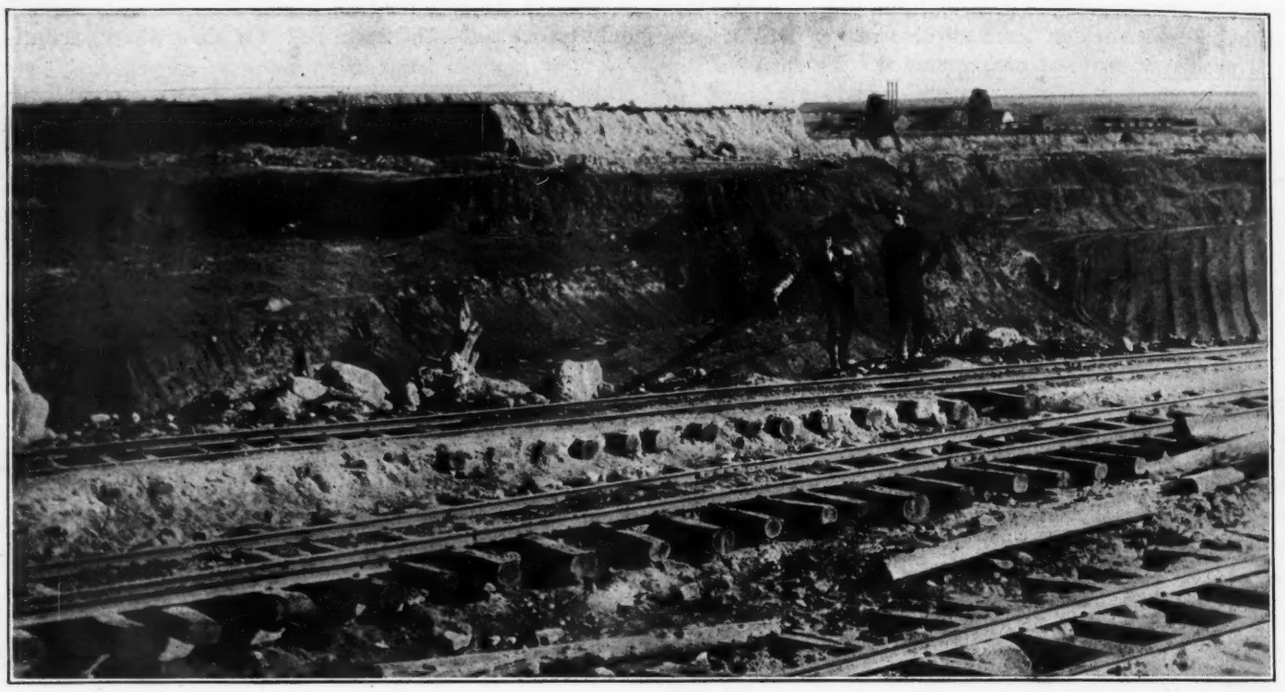

Total Belt Slip, Per Cent.
Cost of Coal per Ton in Dollars
Cost of avoidable Belt Slip per Year in Dollars
Tons of Coal burned per Year
COPYRIGHT, 1918, BY CLING SURFACE CO. BUFFALO N.Y.
A
B
C
D
E

CHART FOR THE DETERMINATION OF LOSS IN MONEY BY AVOIDABLE BELT SLIP

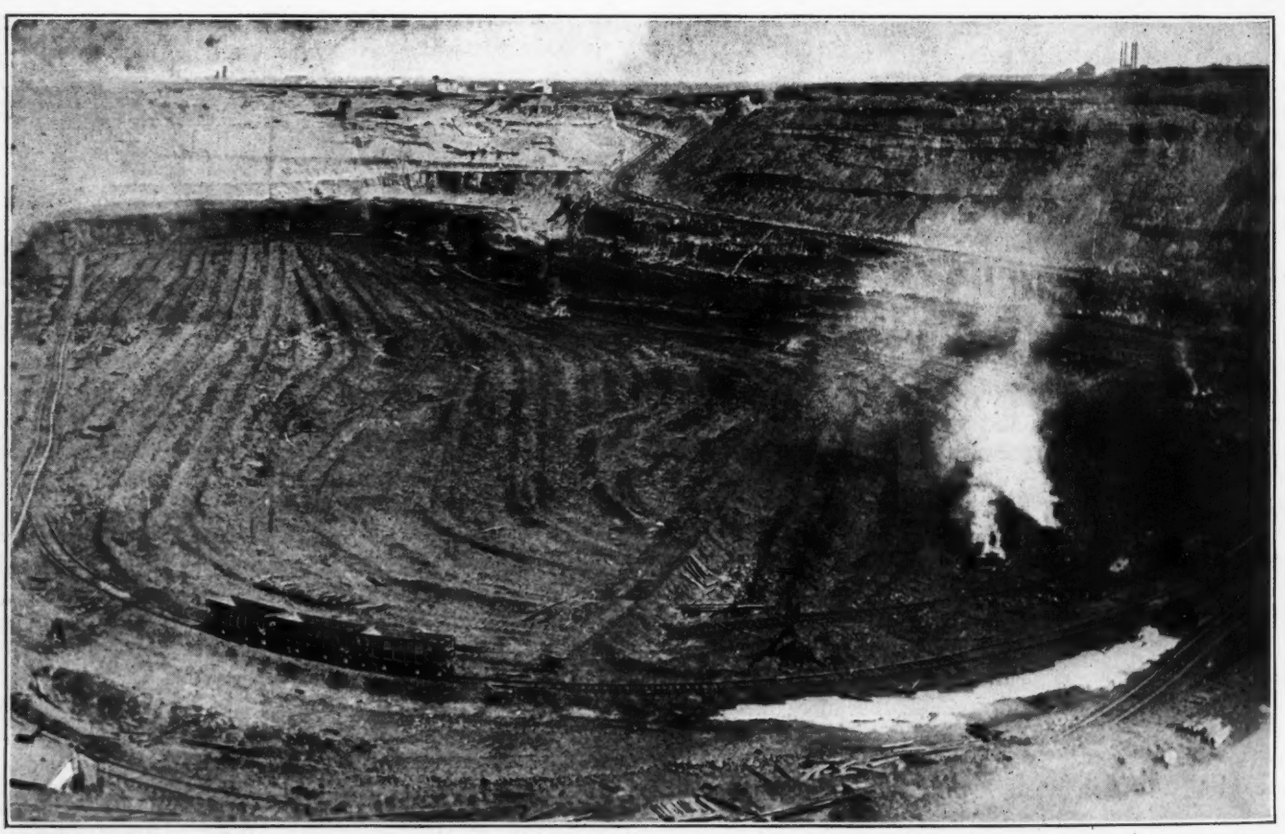
As an example of the total belt slip per cent.: If by means of a revolution counter it is found that a driven pulley is making only 940 r.p.m., and that without slip it should make 1000 r.p.m., 60 r.p.m, therefore, are being absolutely lost. Dividing 60 by the r.p.m. that the pulley should make, 0.06 is obtained, or 6 per cent., which is the belt slip. After having made this determination, it is a simple matter to apply the data to the chart. Belts to which a proper belt dressing has been applied do not slip and do not require high tension, and therefore can be allowed to run with plenty of slack. Every belt thus relieved of undue tension reduces by that amount the total frictional loss, and this means also a longer-lived belt, cooler bearings, less oil consumption, less time lost in repairs and more power delivered at the machine.

The Increased Demands for Asbestos due to the war have been met largely by increased imports from Canada, states the U. S. Geological Survey. The imports of asbestos from South Africa and Italy have been largely cut off. The demand for imported asbestos for use in filters is being supplied by residual deposits of the crystalline rocks of Maryland.

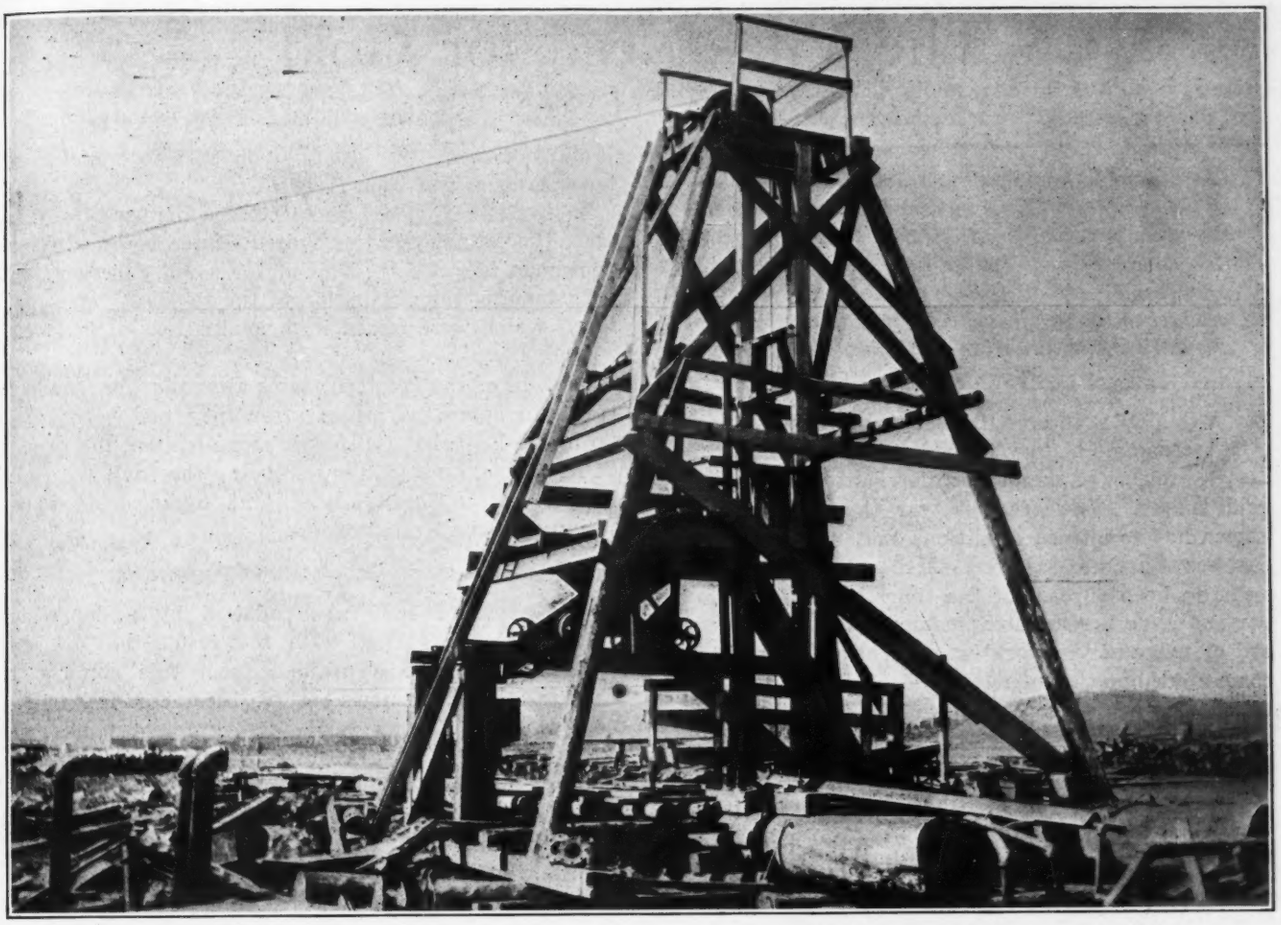
Photographs from the Field



MORRIS MINE AT HIBBING, MINN. ONE OF THE LARGE OPEN-PIT PRODUCERS OF THE MESABI RANGE



BUFFALO AND SUSQUEHANNA OPEN PIT AT HIBBING, MINN. VIEW LOOKING EAST



TEMPORARY HEADFRAME, SHOWING BEARING TIMBERS, GUIDE AND SINKING BUCKET AND DUMPING CAR

REMOVING ORE FROM A MESABI RANGE OPEN PIT AFTER COMPLETING STEAM-SHOVEL OPERATIONS

The Vital Need for Gold*

By JOHN CLAUSEN†

The economic history of the distribution and use of gold as currency is outlined, and the imperative need for ample output shown. The proposition to raise the value of gold is considered impracticable, and a Government bonus for gold production is suggested as a feasible method of alleviating the situation menacing the industry.

NO MORE interesting chapter will be written in economic history than that which deals with the problem of the proper distribution of the world's gold supply. The greatest war the world has ever known has so altered conditions that new methods and customs must necessarily take the place of the old in order to keep abreast of the times. In reality an important issue is presented; namely, whether the standard of value of the world will in future be gold or become a combination of silver and gold, and, if so, what effect such changes would have on the trading powers of nations.

Early Shortage of Specie

There are many interesting angles from which to view this important subject, but it may be of general benefit to recount what happened in this country during and after the Civil War and what has occurred in Europe since the beginning of the present hostilities.

As an inevitable result of Government policy which had placed upon the banks a burden too heavy for them to carry, the financial institutions in New York and other sections were, during the Civil War, forced to discontinue specie payments, which subsequently brought about the suspension of the national treasury.

At the beginning of 1862 a bill was introduced which had for its purpose the making of Government notes legal tender. The issue of greenbacks payable to bearer was authorized up to a maximum of $400,000,000. When the greenbacks were issued it was expected that they would circulate at par with the gold dollar, containing 23.2 grains of pure metal, but a year after the first legal-tender act had been passed, paper money had an exchange value equal only to 14.5 grains of gold. Its value rose in August, 1863, to 18.4 grains, but fell in July, 1864, to nine grains, which was its lowest point. The premium on gold was then such that a dollar in paper money was not worth more than 36c. in gold coin.

Gold Cornering in 1864

The most striking example of profiteering during that period was the "Black Friday Conspiracy" of Sept. 24, 1864, when a group of speculators bought up large quantities of gold—creating an artificial scarcity—and, as a result, that commodity could be obtained only from this clique at ruinous terms. This brought about many failures, and to check gambling in gold and reduce the premium on it, the anti-gold law was passed, but as it did not bring the premium on gold to a materially lower level, it was soon repealed.

In June, 1862, Congress authorized the use of postage and other stamps of the United States because of the enormous increase in demand for small currency, notwithstanding the circulation of the so-called "shin-plasters," which were issued in denominations of 5, 10, 20, 25 and 50 cents.

In some of the Western states attempts were made to maintain specie payments after they had been given up in the East, but California alone had the distinction of remaining on a gold basis during the Civil War, and it was not until 1876 that gold again sold at par throughout the United States.

Export of Gold Causes Shrinkage

The panic of 1893 was followed by a depression throughout the nation, with the result that a large amount of gold was drained from this country to Europe. The Treasury's reserve became so low in November, 1894, that a sale of Government bonds was resorted to; in fact, the stock of coin was reduced to such an extent that there were outstanding more gold notes than coin, leaving a part of the certificates represented by bullion in the form of bars. Again during February of 1895 and also in July of the following year, strong syndicates headed by leading bankers in New York accomplished the difficult task of bolstering up the finances of the United States Government; and it was due largely to their activities that the United States remained on a gold basis. The success of these combinations had a far-reaching influence on business, and as soon as it was seen that the gold obtained from abroad was not going to be lost at once, as in previous bond sales, confidence was again revived and the financial position of the United States improved so favorably in the eyes of Europe that it was possible to float large blocks of American securities abroad.

In August of 1914 foreign exchange became demoralized, and to remedy that situation a gold pool was again created, when leading banks and bankers throughout the country joined in an agreement to provide for mail and telegraphic transfers to Europe in lieu of gold for export, which proved a helpful factor in restoring order and confidence.

International Scramble for Gold

For several years prior to the declaration of war in Europe, the countries of France, Russia and Germany especially had been engaged in a competitive scramble for gold, which resulted in the holdings of their great state institutions expanding rapidly. The embargo which was universally adopted clearly demonstrates the desire of every commercial nation to control and retain its supply of gold. As far as the United States is concerned, except for the necessity of obtaining Government permission to export gold in coin for bars, its circulation in this country has not been restricted.

It has lately been said that the world is divided into

*Excerpt from an address to the American Gold Conference, at Reno, Nev., Aug. 13, 1918.

†Vice president, Crocker National Bank, San Francisco, Calif.

two classes of countries; those which refuse to accept gold and those which refuse to part with it. Gold in bars or foreign coins is not legal tender anywhere. No person in Scandinavia, for example, could be made to take gold bars or American eagles in reimbursement for goods or to meet a required payment in legal-tender currency of that country.

Credit Cannot Displace Gold

There are comparatively few who really understand to what a great extent mere credit can be made to do the work of wealth, although the time will come when credit will assuredly break down unless it is built upon a solid foundation. The issue and circulation of paper credits throughout the leading nations of the world has been proportionately far greater than their holdings of gold and has naturally resulted in inflation on an alarming scale.

The thought, however, that Europe may possibly repudiate part of her war debts for the sake of reducing the amount of currency outstanding against government bonds or notes, is obviously superficial. Finance has become an international, rather than a national, question, and the monetary history of any one country tends to become more and more merged in the monetary history of the whole civilized world. International credit is firmly established on a gold basis, and unless the flow of gold is not too strong in one direction, no country has any interest in upsetting the present standard, although it is contended that, notwithstanding a great production of new gold, it may not necessarily make universal gold standardism possible, as it would be a mere drop in the bucket of future needs. If the world's credit, therefore, is to be carried on after the war with gold, every ounce that can possibly be produced will be required.

Production of Gold Vital

The production of gold is a vitally essential industry, which, for obvious reasons, should be promoted to the fullest extent. It is apparent, however, that with a fixed value for the yellow metal, together with the rapidly increasing cost of material, labor and transportation, this particular industry, as now developed, is seriously affected, and it would seem inevitable that unless some form of Government bonus—but only as a temporary measure—is given to the producing mines, many of them will inevitably be compelled to discontinue operations.

Some persons argue that if the Government would agree upon a plan to increase the value of gold from $20.7 to, say, $40 or $50 a fine ounce, it would make a settlement of obligations possible with only half the metallic requirement otherwise necessary to redeem outstanding paper credits. This course, radical to say the least, would have a disastrous effect upon all credits, and especially reflect upon the cost of living, which, in all probability, would climb to limits beyond the reach of the average citizen. Increasing the value of gold or giving it a premium does not necessarily give it a higher purchasing power, but, on the other hand, in the final adjustment seriously disrupts the basis of international credit.

When peace comes, all the world will be faced with a period of great financial and industrial uncertainty, and to pass through it successfully will be a task that will need all the statesmanship civilization can muster. To increase this uncertainty by tampering with the standard of international payment would be an extraordinarily futile means of handling the situation and would only make the confusion worse confounded.

The principal nations of the world have adopted gold as the basis of their currency system. The market price for it is everywhere the same. It may be an anomaly that economic civilization should depend for means of payment on the supply of a particular metal, but it will take much ingenuity to find a practical substitute for gold and secure for it the popularity and confidence that gold now enjoys. The mere fact that it has been chosen by the most enlightened commercial nations is strong proof that it is the best single commodity for practical use as a standard.

Adequate Gold Foundation Imperative

The disproportionate distribution of gold among world nations attracts attention to the study of the part that this metal plays and is to play in future in the world's economic affairs, and the question naturally arises whether the production of gold is keeping pace with the world's expansion or credit.

The vast obligations piled up by the nations at war; the huge issues of paper currency; the refunding of debts and resumption of specie after the war, are among the most urgent and difficult problems with which the world will be confronted. This makes it only too apparent that gold is a necessity for the credit and financial unity of nations, and it is therefore essential that an adequate foundation of gold must be created to uphold that system.

The United States stands in the unique position of possessing more gold than any nation has ever before owned at one time, but if America is to perform the part that destiny seems to have laid out for her as the world's banker, it will without doubt be necessary to further increase the nation's gold holdings, and for this reason encourage gold production to the fullest extent.

Eucalyptus-Oil Production in Australia

The eucalyptus-oil industry is now of considerable importance in New South Wales, states the *Perfumery and Essential Oil Record.* The oils are used for three purposes—in pharmacy, in the separation of metallic sulphides, and for perfumery and flavoring. *Eucalyptus macathuri* grows very rapidly, and is being cultivated freely. The leaf oil consists mainly of geraniol, together with geranyl acetate, of which not less than 60% is present in the crude oil. *E. citriodora* yields about 0.75% of an oil consisting almost entirely of the aldehyde citronellal. *E. staigeriana* gives a high yield of citral-bearing oil. There are about 300 species of eucalyptus in Australia, but of these not more than 25 varieties can be utilized for their oil. Up to the present the oil products of about 160 eucalypts have been determined. The value of eucalyptus oil exported from Australia to the United States in 1917 was $24,000 and to Canada $6000; the corresponding values for 1916 were $12,000 and $900.

Adsorption*

Though modern colloid chemistry began with Graham, his distinction between crystalloids and colloids has been dropped, and it is customary to speak of a colloidal state instead of a colloidal substance. Any phase which is sufficiently subdivided is called colloidal, the particular degree of subdivision being entirely arbitrary. According to this definition, colloid chemistry is the chemistry of drops, grains, filaments and films. Though apparently of slight importance, a knowledge of colloidal chemistry is essential to any one who wishes to understand about cement, bricks, pottery, porcelain, glass, enamels, oils, soaps, greases, mineral flotation, smoke prevention, and many branches of industrial chemistry.

Adsorption of Gases and Vapors by Solids

In an extremely subdivided phase, the surface is very large relative to the mass of the phase; and therefore the first step in the study of colloid chemistry is to discuss the properties of surfaces, beginning with the behavior of solids in contact with gases or vapors. All substances tend to adsorb or condense upon their surfaces any gases or vapors with which they come in contact. The amount of adsorption varies with the nature and physical state of the solid and with the nature of the gas; in other words, the adsorption is specific and selective. The amount of gas adsorbed is greater the higher the pressure and the lower the temperature. For example, at 20° C. the respective quantities of different gases adsorbed by 1 c.c. of a finely divided charcoal are: H_2, 7.3; N_2, 21; CO, 26.8; O_2, 25.4; CO_2, 83.8 cubic centimeters.

As a first approximation it is often stated that a gas or vapor is adsorbed more readily the higher its boiling point, but this conclusion is not consistent, since adsorption is specific and varies with the nature of the gas and of the adsorbing solid. The adsorption of gases by charcoal has been extensively studied, because charcoal adsorbs so many gases and adsorbs them so readily. Finely divided quartz will adsorb water vapor, but not to the same extent as amorphous silica. Platinum black may take up 100 volumes of hydrogen, but it is not certain whether this hydrogen is all adsorbed or is partly dissolved. Ramsay considers that the nitrogen found in zinc is due to ammonia adsorbed from the air by zinc.

If the film of adsorbed air on a small particle remains approximately of the same thickness, irrespective of the diameter of the particle, the ratio of air film to mass of particle will increase as the particle grows smaller. Cushman and Coggeshall found that a rock powder which would pass a 200-mesh screen surged like a liquid. When poured into a vessel, it filled only 46% of the space, though coarser powder filled more. It is not surprising that the air cushion around each particle makes the grains move over one another like a liquid. The probable density of the adsorbed gas has been calculated by Mitscherlich in the case of carbon dioxide and boxwood charcoal, and found to be only 1-56th of its original volume.

Since a gas or vapor may be adsorbed by a solid, one might expect to find selective adsorption by a liquid as well, and this proves to be the fact. Lord Rayleigh found that impinging drops of water did not necessarily coalesce. If they were slightly electrified, they coalesced readily, while stronger electrification kept them apart. A film of adsorbed air keeps the uncharged drops from coming into actual contact, and a slight electrification removes this film sufficiently to permit coalescence. Highly charged drops repel each other. Rolling drops are often formed when water drops from an oar on the water, and these depend on the presence of adsorbed air and are also sensitive to the presence of electrified substances. Soap bubbles being hollow drops, it is to be expected that they would behave like liquid drops, though not necessarily like the drops of a pure liquid. It is possible to knock two bubbles together with considerable force without causing them to coalesce. This is due to the presence of adsorbed air films on the surfaces. If the bubbles are electrified slightly they coalesce readily without bursting. If a vapor is adsorbed by a liquid, it will condense to a liquid film at a temperature above that of the normal dew point.

Adsorption of Liquids by Solids

There is selective adsorption of a liquid by a solid. If a liquid is not adsorbed by a solid, it does not wet the latter. Question has arisen whether the liquid meets the wall at a definite angle, the contact angle. Lord Rayleigh states definitely that the contact angle must be zero. This must be true if the liquid is adsorbed by the solid. For a liquid to wet a solid in the presence of air, the liquid must be adsorbed more strongly than the air and must displace it. The floating of metallic powders on water is due to the slowness with which the water wets them. By oiling the meshes of a fine screen it is found that air can pass, but water does not wet the wires, and consequently surface tension prevents it from passing the holes.

The adsorption of liquids by solids is selective, and a given solid will adsorb one liquid more than a second liquid. Consequently the first liquid will displace the second from contact with the solid. No systematic study of this phenomenon seems to have been made, but it is known that kerosene will displace water in contact with copper and water will displace kerosene in contact with quartz; and that alcohol will displace oil in contact with metal and linseed oil will displace water in contact with white lead. The whole process of oil flotation depends on the fact that ore adsorbs oil more strongly than does the gangue.

There is hardly any quantitative data on selective adsorption. Graham made a few rough measurements on the selective adsorption of liquids by palladium and found that 1000 parts of palladium foil retained 1.18 parts of water, 5.5 of alcohol, 1.7 of ether, 0.54 of acetone, 4.5 of glycerine, 10.2 of castor oil, and 18.1 parts of oil of sweet almonds.

Intense strains may be set up if the adsorption is very marked. Gelatine is adsorbed so strongly by glass that the gelatine film in drying will often tear away fragments of glass. On the other hand, it will not adhere to plates of mica or calcite.

Dried glue may be considered either as a solid or as a super-cooled liquid. Considered as a solid, the

*Condensed from a paper by Wilder D. Bancroft, professor of physical chemistry, Cornell University, in the "Journal of the Franklin Institute," "Outlines of Colloid Chemistry," Jan., Feb., Mar., 1918.

adsorption of gelatine by glass is a case of adsorption of a solid by a solid. If a metal is polished with rouge which is not kept sufficiently moist, the rouge adheres so firmly to the metal surface that it cannot be removed without spoiling the polish. In the case of blue powder, grains of zinc are coated with zinc oxide that adheres even when the zinc is melted. Aluminum and nickel are always coated with solid surface films which have marked effects on the properties of the metals. All patinas on metals involve adsorption; otherwise they would come off readily. Passive iron owes its peculiar properties to the adsorption and stabilization of a higher oxide, either FeO_2 or FeO_3.

There is an apparent case of adsorption of a solid by a solid if a moderately coarse powder is shaken with a much finer powder. Instead of the finer powder filling the voids in the space occupied by the coarse powder, it tends to coat the coarse particles.

Adsorption of Liquids by Liquids

The spreading of one film over another is usually considered to depend on the relative surface tensions, but a simpler way to treat it is to consider it as a case of adsorption. If oil is adsorbed by water, it wets the water and spreads over the surface. The adsorbed layer is very thin. If the oil is not adsorbed by the water there is no spreading.

Adsorption of Solids by Liquids

A solid which is wetted by a liquid adheres to the liquid. With two liquids and one solid, there is selective adsorption of the solid. Finely divided red lead when shaken with water and benzene adheres to the surface of the benzene, making a practically continuous coating around the organic liquid (if proper relative amounts are used). Des Condres explains this by stating that if water displaces benzene from the surface of a given solid, the solid will tend to stay in the water phase; if the benzene displaces the water, the solid tends to remain in the benzene phase. Only when fairly fine do the solid particles stay in the interface or in the upper liquid layer. Where copper powder is shaken with kerosene and water it goes into the interface, producing an effect of molten copper. If allowed to stand, the metallic powder creeps up the side of the vessel above the surface of the liquid.

Adsorption from Solution by Solid

Selective adsorption from a solution by a solid may show itself by relatively more of the dissolved substance being adsorbed than of the solvent, or by relatively less being adsorbed. Infusorial earth will remove all the color from aqueous solutions of some analine dyes. The adsorption of dyes by hydrous alumina, stannic oxide or other mordants, as they are called, is of great importance. As in all cases, the adsorption is selective, some dyes being taken out and others not.

General Observations

Since adsorption is essentially specific, the amount will necessarily vary with the nature of the adsorbing agent, the liquid and the substance to be adsorbed.

Selective adsorption connotes the possibility of chemical decomposition as a result of adsorption. If a given solid adsorbs a base more strongly than an acid, for instance, there will be a tendency for the salt to hydrolize, the base being adsorbed to a greater extent than the acid. Thus a neutral solution will become acid if shaken with a solid which adsorbs the base more strongly than the acid; it will become alkaline if the solid adsorbs the acid much more strongly than the base, and it will remain neutral in case the solid does not adsorb either base or acid at all, or in case it adsorbs the two in practically equivalent quantities.

America Supports Britain in Protest To Mexico

Great Britain's protest to Mexico, that the oil decree of Feb. 22 was confiscatory and in violation of the rights of British companies holding oil claims, provoked a vigorous reply, in which it was maintained that Mexico is free to adopt such fiscal legislation as it pleases, that recourse to the local courts rather than to diplomacy should be adopted to test the justice of any decree, and that it would be equally unjustifiable for Mexico to object to the war taxes in England. Unfortunately, history has shown that the local courts are controlled in their decisions by certain branches of the government, and that it is often impossible for foreigners to obtain justice. Mexico contended that the new decree affected foreigners and Mexicans alike, which is literally true; but the fact remains that practically all the oil properties are owned by foreigners, and it is upon them, and not upon Mexicans, that the burden and injustice of the new decree would fall.

The American authorities indorsed the British protest, and the oil companies of both nationalities united in agreement to refuse to acquiesce in the Mexican government's demands and relied on their respective governments for support. Manager Ballin, of the Hamburg American Line, is reported to have recently stated in public that "After the war is over, we are assured of extensive oil possessions overseas"—an anticipation which doubtless inferred the elimination of American and British oil holdings in Mexico in the meantime. Under the decree of Feb. 22, Mexico attempted to make oil the property of the nation. Mexican petroleum would then become a nationally owned contraband, and, as such, might not be sold by a neutral country to a belligerent under the existing international laws.

Fortunately, recent advices from Mexico indicate that the government is inclined to modify its view; and although the cancellation of certain provisions in a former decree are not completely satisfactory, it appears that a basis of agreement may be reached which will be acceptable to the governments concerned.

Lake Copper Co.

The report of the Lake Copper Co., of the Michigan copper district, for the year ended Apr. 30, 1918, indicates a net loss of $30,834. The production amounted to 1,461,893 lb. of copper, which sold at an average of 25.57c. per lb. and netted $373,814. Miscellaneous receipts increased the income to a total of $390,165. Operating expenses were $391,647, taxes, $21,804, and new equipment cost $7547. Rock stamped was 63,191 tons, yielding 2,246,145 lb., averaging 65.07% copper.

Changes in Alaska Juneau Mill

It is frequently a matter of surprise to both managers and owners of mining enterprises that delays occur in bringing newly constructed plants to capacity; also that costs of construction and operation exceed the engineers' estimates. Such matters often lead to exchanges of acidulated pleasantry between managers and engineers, and between engineers and operators, with the result that a considerable amount of time is wasted in futile attempts to place the responsibility, on the one side, and to evade it, on the other. Delays of this kind do not always call for caustic comment. A large proportion of the "mistakes," as they are called, in the design of a plant, are in the nature of experiments needed to indicate the correct procedure. Again, incompetent and inexperienced men are sometimes intrusted by equally incompetent managers with the design of important metallurgical works—with obvious and inevitable results.

The annual report of the Alaska Juneau Gold Mining Co., whose mill began crushing early in 1917, gives a summary of the difficulties encountered and the changes that were found necessary in order to insure smooth operation. This matter should be of interest to mill operators and designers of new plants, as it illustrates several common shortcomings in mill construction. It should be even more useful in indicating to operators, managers, and stockholders in mining ventures the vicissitudes and delays to which such a plant may be subjected, even when under competent direction.

Mill Tonnage and Costs Disappointing

The mill was designed to treat 8000 tons per day, but for nine months the best it could accomplish was less than half its promised capacity, at an operating cost of more than double the estimated expense per ton. As soon as one ball-mill section was started, it was evident the machines were not crushing the amount of ore anticipated. Various reasons were suspected and investigated, but the coarseness of the feed was finally determined as being the deterrent factor that limited the ball-mill output. Finer preliminary crushing was then adopted, with the result that the amount of ore reduced per ball-mill day was increased from 253 tons in April to 436 tons in September. Serious breakages of the No. 9 gyratories, which precede the ball mills, made it necessary to reduce the duty to about 370 tons per day. It was evident that the ultimate capacity of the ball mills when fed with material crushed to pass a 1½-in. ring is not less than 700 tons per mill day, and arrangements will be made to install intermediate crushers between the gyratories and ball mills. The fallacy of ignoring the high efficiency of a crusher for primary reduction and the mistake of expecting good results from a ball mill fed with too coarse a product are often complementary errors.

The report for 1916 indicated the milling equipment as follows:

Coarse crushing plants: Two revolving tipples, each with a capacity of four 10-ton cars; coarse-ore bin of 2000 tons' capacity; four 60-in. apron feeders; four 8 x 5 ft. grizzlies with 8-in. openings; two 36 x 48 in. jaw crushers; four 4 x 8 ft. grizzlies with 3-in. openings; four No. 9 Gates crushers; four 30-in. conveyors; four distributing boxes; two 36-in. shuttle conveyors.

Concentrating department: Mill ore bin of 8000 tons' capacity; twenty-four 30-in. apron feeders; twelve 8 x 6 ft. ball mills; 12 revolving screens; 12 V-tanks; 12 mechanical distributing boxes; 48 roughing tables; 24 classifiers; 12 shovel wheels; twelve 6 x 12-ft. tube mills; 24 settling tanks; 24 mechanical distributors; 96 finishing tables and 12 Wilfley tables.

Retreatment plant: Two 5 x 5-ft. "ball-peb" mills; two 4-in. centrifugal pumps; one 4-spigot classifier; and the necessary number of concentrating tables, which can be added to from time to time to meet any improvements made in the re-treatment methods.

Among the changes and additions needed to remedy mechanical defects and weaknesses of the plant as first built are those given in the following list, and taken from the 1917 report:

Coarse Crushing Plant

Six-inch faced tight-and-loose pulleys installed on feeders in place of 4-in. faced cone pulleys and clutches.

Six-inch grizzlies removed and all feed put through jaw crusher.

Slide plate and lip installed under jaw crusher.

Concaves on all gyratories set out 1¾ inch.

Spacing of grizzlies changed from 2½ in. to 1½ inches.

Runway built over jaw crushers, and shafting levers installed for operation of feeders.

Gallery platform built around feeders.

New concrete foundations built under jaw-crusher columns.

Trenches built under 30-in. apron conveyors, and launder system installed from trenches to ball mills.

Launder and hoppers installed for sluicing feeder drippings to ball mills.

Alterations made to 30-in. belt-conveyor hoppers.

Pump and 3-in. pipe line installed for pumping water to coarse crushing plant for cooling and sluicing.

Intermediate Crushing Department

Revolution counters installed on all ball-mill feeders.

Hopper bottom built under ball-mill feed, and pipe line installed for sluicing drippings to ball mills.

One additional concrete pier poured under each ball-mill pinion shaft.

Ball-mill feed hoppers enlarged 16 inches.

New plate scoop built for ball mills.

Trunnion screens lengthened from 30 to 34 inches.

Large junction boxes installed and launders given greater inclination, and lined with cast iron for ball-mill tunnion screen oversize to tube mill.

Heavier cables installed on all ball-mill belt tighteners.

Finishing Department

One Deister classifier installed in each section ahead of V-tanks.

Goosenecks on all V-tanks lowered 12 in. and new discharge boxes installed.

Hydraulic water mains to V-tanks enlarged from 1½ to 2 inches.

Greater inclination given all launders and distributor to finisher tables.

Re-treatment Department

Four additional Deister tables and one 4-spigot classifier installed to treat reground iron concentrate.

Alterations made to 4-in. pump discharge pipes from pump to equalizing box on finisher floor to divide the product to the two Deister classifiers.

Amalgam barrel and plate installed to amalgamate all "rougher" concentrates.

Pump and launder system installed for the continuous treatment of shipping concentrates.

Two tables installed for re-treating "rougher" iron before regrinding.

Two 10-in. elevators installed in place of two 6-in. elevators. Elevator main-shaft drive changed from "ball-peb" pinion shaft to independent motor drive.

Two tanks and floor installed for handling shipping concentrate.

Larger floor-wash launders installed for re-treatment floor.

New tailing flume installed and all connecting launders thereto.

A 9 x 8-in. air compressor and pipe lines installed for general mill use.

The capacity of the receiving bins was less than expected, and this interfered both with tramming and milling operations. Every interruption to tramming interfered with coarse crushing and every interruption to coarse crushing interfered with tramming. The bins have a theoretical capacity of 2000 tons each, but owing to the steep angle of flow of the mine rock and to the position of the discharge openings their effective capacity is not more than 1200 tons each.

Caylloma Silver Mines*

The silver mines of Caylloma, Peru, are located in the Province of Caylloma, Department of Arequipa, about a league from the small mountain town of Caylloma. The altitude varies from 14,000 to 16,000 ft. above sea level. The climate is healthful and the average rainfall 26 in. Practically all of this falls during the wet season from December to March.

The shipping port of Caylloma is Mollendo, at which place all goods arrive for the mines and whence all ores are shipped. Sumbay, the nearest station to the Caylloma mines, is 285 km. from Mollendo on the line of the Southern Railway. From Sumbay a mule road leads to the mines, 120 km. distant, passing through the native villages of Callalli and Sibayo, where it crosses the river Colca. This road cannot be used during the wet season, owing to the impossibility of fording the river at that time; so another road through the village of Chivay has to be used, an old Spanish bridge permitting the passage of the river.

The silver mines of Caylloma were discovered by the Spaniards about 1630, but they were worked previously to this by the Incas. Judging from old official documents kept in order to collect the royalty of "one fifth" due to the King of Spain, the amount of silver produced must have been enormous. The town of Caylloma was made a "Caja Real," or Royal Treasury, to facilitate the collection of this royalty and to distribute the necessary quicksilver.

The San Cristobal lode, the largest in the district, is nearly two miles long and averages 25 ft. in width. This lode was worked by the Spaniards to a depth of 400 ft., when they were driven out by the war of independence in 1821. Until 1880, practically nothing was done, on account of the unsettled state of the country. About 1886, the formation of several small companies to work the mines is recorded; and in 1889, the Caylloma Silver Mining Co., a London corporation, was established and took over the greater part of the holdings. This company worked the mines until 1905, producing about 7,000,000 oz. The capital of the Caylloma Silver Mining Co. was £250,000, and that company had paid £150,000 for the property in 1890. By 1900 the surplus capital had all been spent in plant and equipment.

From 1900 to 1904, operations at the properties of the Caylloma Silver Mining Co. were greatly curtailed. Practically nothing was done except to ship high-grade ore from the San Cristobal and Santa Cata mine. In 1905 a new company was formed, largely with Chilean capital, the name of the concern being altered to the Sociedad Esploradora de Caylloma. In 1905-06 machinery was purchased for a hydro-electric power plant and for transmission line, electric pumps and compressors for sinking the Santa Cata shaft, and 12 km. of narrow-gage railway was built from San Ignacio to the Bateas mine, and also to connect the San Pedro and Santa Isabel mines with San Ignacio. In addition, a 60-ton concentration mill was brought in and began operation in 1907. The electric power station was put in commission in 1910. The water power for this station is taken from Villafro lake, which gives about 1000 ft. fall and is one of the sources of the Amazon. This mill and station were operated until about 1912, when the mill was shut down. The power station continued operation for development and production at the mines.

In 1913 there was a further reorganization of the company, new capital being raised and the name of the company altered to Sociedad Esploradora de Caylloma Consolidada. A capital expenditure of about £40,000 was made, with the object of increasing the capacity of the mill and concentration plant. A mill was installed with 12 Nissen stamps to treat 100 tons of ore per day, after which a preliminary concentration followed by cyaniding was planned. Double-cyanide treatment of sand and slimes was arranged for. The entire mill was electrically operated, and the power increased by the installation of a 160-hp. plant, equipment previously having supplied 360 hp. The whole plant was to be in running order by the middle of 1915, with a capacity of treating 36,000 tons of ore per month, running 30 oz. of silver to the ton. It was stated in 1914 that the mines were exporting 12,000 oz. of silver per month from picked ore running as high as 300 to 400 oz. per ton.

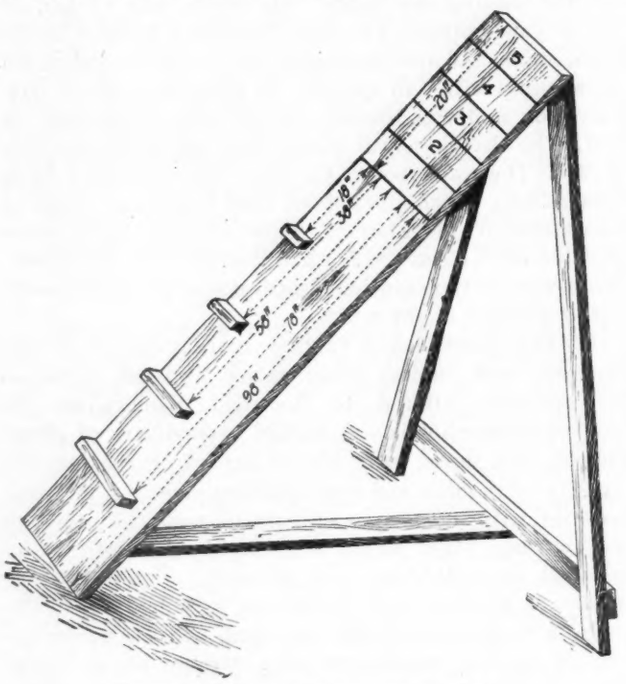
The connection of the mines of San Cristobal, Santa Cata and Flor del Mundo was completed about 1913, a tunnel 3 km. in length being driven from one side to the other of the hill in which these mines are situated. The cyanide mill and extra power station were completed and placed in operation about June, 1916, since when they have been running more or less continuously to the present date; but not with the expected result. In 1917 a flotation plant was added, and so far the results are said to have been satisfactory. Early in the present year a new directorate was formed and more capital was raised.

*Excerpted from "The West Coast Leader."

Details of Practical Mining

Conservation of Drill Steel

That it pays to keep a large number of drills in service has been often maintained, and not without sound reason, the main object being to reduce the amount of breakage that may be attributable to "fatigue" of the steel. Records show that a reduction in the number of broken drills may be accomplished by giving each drill an occasional "rest." In a large shop a great many steels must be sharpened on every shift, and there is a constant demand from the mine for additional drills of the lengths of which there is a shortage. Under such conditions, the problem of controlling the periods of work and rest for each drill must be difficult, demanding an exceptional degree of competency and attention to detail.



RACK USED FOR SORTING DRILLS

At present the industry is confronted by a serious shortage of supply of drill steel, and few mines have an excess stock. Those with ample supplies will do well, therefore, to profit by the unfortunate experience of others and make their steel last as long as possible.

The usual problem is to get enough steel to keep all the machines running, so that the mine's output may be maintained, or increased, if possible. This calls for keeping all the steel on the job all the time, and precludes the possibility of giving it an occasional rest. Yet at many plants there are five or six times as many drills in the mine and shop as are used every shift. And these are just the cases where there is always an apparent shortage of steel. Any manager who thinks this condition doesn't apply to his mine ought to make a complete drill inventory and compare the total with the number of drills used per shift. The ratio may not be as high as five or six to one, but there are few cases, indeed, where it is less than three or four to one.

Assuming that it is advisable or necessary to run the mine on the smallest possible amount of steel, how can it best be done? First, run the drill sharpener the same number of shifts as the mine. There is thus required, theoretically, twice as much steel as is used on one shift, one shift's supply being in the shop and another underground in actual use. Compare this with the condition where a mine is operated two shifts and the sharpening is all done on one of them, and there are twice as many dull drills in the shop to be sharpened as there are sharp drills in the mine to be used, or a theoretical ratio of three to one. Three shifts drilling and one sharpening would give a four to one ratio.

Of course, the theoretical minimum ratio of two to one would not work out in practice, because the miner cannot use all the drills he gets for his shift's work. Aside from those that are soft or that break, many are too long or too short to work in with the rest of the set. As a rule, these are put aside and, in consequence, collect dust or become buried. Many drills stand idle for long periods or become lost in this way. A good "nipper" can do a lot to overcome such a condition, but why depend on a "nipper," who is generally more intent on putting in a shift than on straightening out difficulties that concern the miner and the blacksmith?

To obviate the loss and inconvenience due to neglect of drills, it is necessary to make sure that all the drills issued to one particular miner or party of miners using the same steel are of such lengths that any second drill will follow any starter, any third drill will follow any second drill and so on progressively through the series. With these conditions, it would be reasonably certain that all the steel could be used except those pieces that had improper temper. Thus is eliminated the setting aside of drills that are too long or too short, with the consequent waste of steel and delay and inconvenience to the miner.

LENGTHS IN INCHES OF CLASSIFIED STEEL DRILLS

Starters	18– 22	22– 26	26– 30	30– 34	34– 38
2nd drills	38– 42	42– 46	46– 50	50– 54	54– 58
3rd drills	58– 62	62– 66	66– 70	70– 74	74– 78
4th drills	78– 82	82– 86	86– 90	90– 94	94– 98
5th drills	98–102	102–106	106–110	110–114	114–118

The most practical way to conserve the drill equipment is to sort over the steel before it is sent underground. How this should be done depends on conditions. Generally, where there is about 20 in. difference in length between two successive drills and the shortest starter 18 in. long, by classifying the steel according to length, one could get it sorted into five different piles represented by the five columns of the accompanying table. In each column the lines represent the starters, second drills, and other sizes, as shown, their lengths in inches being within the limits given by the figures stated.

In the first column, for example, all the starters are from 18 to 22 in. long, all the second drills from 38 to 42 in., the other sizes being confined to the lengths indicated. Thus no second drill is more than 24 nor less than 16 in. longer than any starter, and the same applies to each successive length, and a miner whose drills all conformed to the lengths given in Column 1 could use them all without inconvenience.

The accompanying sketch shows a simple and inexpensive method of sorting the drills. They are merely stood up on the various cleats and placed in a rack the number of which is the same as that of the space on the measuring board on which the end of the drill falls. One man could do the classifying rapidly. Then the steel could be sent out in rings and so distributed that each miner or party has steel from only one rack.

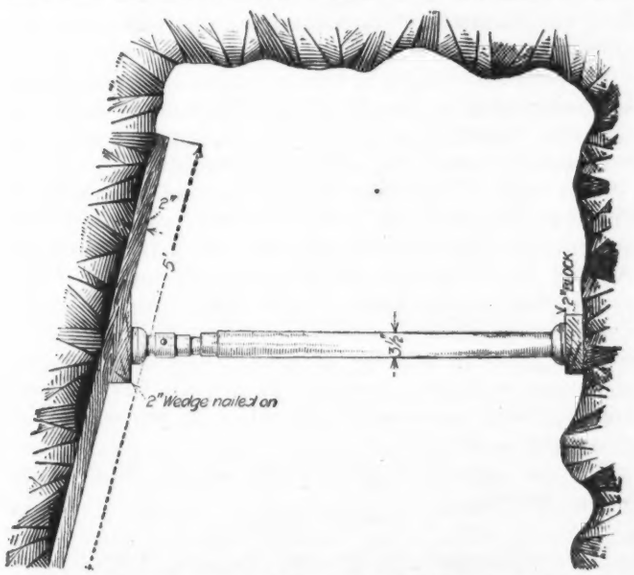
Another way in which a saving in steel can be accomplished is by using smaller steel. In many places where 1¼-in. steel is being used through force of habit, 1-in. steel may be employed to good advantage. In fact, the suggested arrangement makes it possible to use smaller bits and thus materially increase the speed of drilling.

It would be to the interest of drill-steel manufacturers to induce their customers to use smaller steel in order to conserve the present supply of raw material.

A Machine-Drill Crossbar Set-Up

By C. T. Rice

To make a satisfactory set-up with a machine drill crossbar when the sides of a drift diverge considerably from the face at the point where the bar must be placed, a 2-in. plank is placed horizontally along the receding wall, and the bearing face squared up by means of a



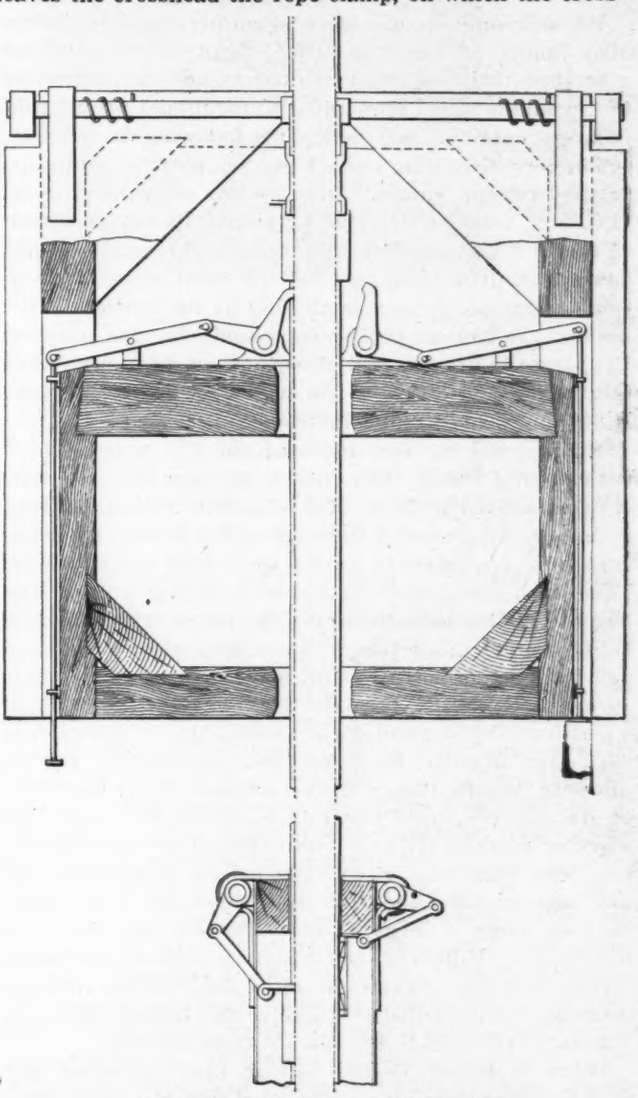
PLAN VIEW OF DRIFT HEADING WITH RECEDING WALL, SHOWING SET-UP OF HORIZONTAL DRILL BAR

wedge nailed to its middle point where the crow-foot bears. A couple of powder boxes can be used as a support or one end can be propped until the horizontal plank can be properly positioned, and the jack-screw turned until the bar holds itself in place. It does not matter if the plank does not rest directly against the wall right behind the head of the crossbar. Such a discrepancy is easily remedied by means of filling pieces which will stick as long as the horizontal piece, and this plank has such a contact along the wall that once the bar is jacketed tight it cannot kick out.

Improved Safety Crosshead

By J. B. Calkins*

A safety crosshead as illustrated herewith has met success in shaft-sinking work connected with salt mining in New York State. The construction is exceedingly simple, and it will be noted that as soon as the bucket leaves the crosshead the rope clamp, on which the cross-



IMPROVED SAFETY CROSSHEAD

head rides, will release the safety dogs and then be engaged by the clamps in the center, thus preventing the bucket from going further. The rope clamp has new features, as it is self-tightening, cannot damage the rope, and has no nuts or bolts in its construction to become loose. It consists of a set of four split conical wedge blocks around the rope, screwed tightly into the casing from each side. Any tendency for the rope to slide through will cause the blocks to engage tighter. It will be noticed that the wedge blocks are set in pairs in each direction to prevent movement either up or down.

*Assistant general manager and chief engineer to the Rock Salt Corporation, Ithaca, New York.

Assayer and Chemist

Analysis of Ferrozirconium And Zirconium in Steel

By J. D. Ferguson*

Ferrozirconium is the most recent arrival in the ferroalloy family. I found no little difficulty in working out a method more especially suited to the determination of zirconium where iron and also aluminum are present in large quantities, and append the following description:

For ferrozirconium use a 1 gm. sample; for zirconium in steel a 3 gm. sample. Dissolve in a mixture of 10 cc. H_2O, 5 cc. conc. HNO_3, and 5 cc. conc. HCl, using about 25 cc. for 1 gm. and 50 cc. for 3 gm. This mixture boils down with little bumping, and the residue, on evaporation to dryness, is in a small ring at the bottom of the beaker. A 250 cc. beaker is suitable for the purpose. Evaporate to dryness and absence of white fumes. Cool the beaker, add 30 cc. of hot water, then 1 cc. of conc. H_2SO_4 and heat till all soluble salts dissolve.

Filter, using suction, and wash the SiO_2 several times with boiling water, then with a mixture of 1 cc. conc. H_2SO_4 dissolved in 20 cc. H_2O heated to boiling, pouring it drop by drop around the edge of the filter. By using care, this is sufficient to wash a small filter several times. Then wash again several times with boiling water. The purpose of this is to have only the necessary amount of H_2SO_4 present in solution. (Those who wish to use more acid may do so, but a careful neutralizing must be performed afterward.) Save the filtrate. Burn the paper in a platinum crucible and ignite thoroughly. If the silica is dark gray in color, insoluble zirconium silicide may be present. Weigh, then add 3 cc. of conc. H_2SO_4 and 3 cc. of HF and evaporate to white fumes of SO_3; cool, and add 3 cc. more of HF and repeat till you are sure all SiO_2 has been removed. Finally evaporate to dryness. If any appreciable residue is left, fuse for ½ hr. with Na_2CO_3, using a large excess; dissolve the fusion in hot water. Filter off the insoluble sodium zirconate, ferric oxide, etc.; ignite the filter and fuse the residue thoroughly with $KHSO_4$. Dissolve the $KHSO_4$ fusion in hot water and add to the filtrate from the SiO_2.

Dilute to 400 cc., heat to boiling, then add slowly and with constant stirring a boiling solution of sodium thiosulphate, dissolving 6 gm. for each gram of alloy taken in the smallest quantity of water necessary. The liquid becomes lighter in color, till finally it is almost colorless and further additions of thiosulphate precipitate sulphur. A little sulphur does no harm, but avoid precipitating a large excess.

Now add, while stirring well, a boiling solution of Na_2HPO_4 (1 gm. dissolved in a small quantity of water). If any appreciable quantity of zirconium is present, it precipitates almost immediately as a whitish or greenish flocculent precipitate. Place on hot plate, boil for a few minutes, let stand for about ½ hr. and filter through a 15 cm. filter paper, not using suction and decanting the excess of liquid carefully at first. In washing, stir up thoroughly by directing a forcible jet of hot water against the sides of the filter and allowing the excess of water to dry away before the next washing. After washing about ten times with hot water in this way, dry the filter thoroughly and burn the precipitate and filter separately. Weigh as zirconium phosphate containing 0.3828% Zr.

The principal points to be noted in this determination are:

1. The iron must be reduced to the ferrous condition.
2. The solution before precipitation must be approximately 1% acid (H_2SO_4), to prevent iron and aluminum from precipitating.
3. A pinkish color to the freshly precipitated zirconium phosphate indicates the presence of titanium. The precipitate containing titanium is washed, dried, and burned as usual, fused with at least 30 times its weight of Na_2CO_3 for ½ hr. to 1 hr., the fusion dissolved in water, and the soluble sodium carbonate and sodium phosphate filtered off, leaving the insoluble sodium zirconate and sodium titanate on the filter. Burn the filter in a platinum crucible and fuse the residue thoroughly with $KHSO_4$. Dissolve the fusion in boiling water. Make 1% acid with H_2SO_4, heat to boiling, and add 20 cc. of 3% hydrogen peroxide to oxidize titanium, then precipitate the zirconium as phosphate as previously done.
4. Minerals containing zirconium are analyzed by the same method as in the case of zirconium precipitates, except that if much iron is present it must be reduced with thiosulphate before zirconium is precipitated.
5. In nickel zirconium alloys dissolve and bake to dryness and filter off SiO_2 as usual. Make filtrate strongly ammoniacal and plate out nickel. Filter off Fe, Al, and Zr precipitates, ignite and treat ignited oxides as minerals are analyzed. Treat SiO_2, if necessary, for zirconium present.
6. In treating all SiO_2 precipitates with HF, when zirconium is present, an equal quantity of H_2SO_4 at least must be used (an excess is desirable) to prevent loss of zirconium as fluoride.
7. Scant zirconium precipitates should stand 24 hr. before filtering.

*Detroit, Michigan.

Illuminating an Assay Or Chemical Balance

In arranging the illumination of a balance, in addition to securing satisfactory lighting of the graduated beam, pans and pointer, care must be taken to avoid unequal expansion of the balance arms, due to heat or disturbance of equilibrium arising from air currents, says B. D. Porritt, in the *Journal of the Society of Chemical Industry*. For these reasons the source of

light should be placed symmetrically to the beam at the top of the balance case and should be as extensive as possible, in order to reduce heat radiation to a minimum and to distribute uniformly such as is unavoidable.

The type of electric lamp in which the light source consists of a metallic filament suspended along a narrow tube seemed to be free from the defects of the ordinary type, since the heat evolved would be slight and widely dissipated, and, further, owing to the shape of the lamp, it could easily be arranged so that any slight heating effect should be uniformly distributed over the beam of the balance.

In the arrangement suggested, a "tubolite" metallic filament lamp of 16 cp., 8½ in. long, is employed, inclosed in a semicircular aluminum reflector, which serves both to direct the light through the glass top into the balance case and to screen the light source from the view of the person weighing. Both these fittings are standard articles in the electrical trade.

In order to insure the lamp and reflector always being placed symmetrically to and slightly in front of the balance arm, two upright brass springs are attached to the woodwork of the balance case; and into circular counter-sunk holes in these are sprung the bosses at each end of the reflector. The lamp and fittings can therefore be removed for cleaning or other reasons by merely loosening the springs; and, to facilitate this operation, they are each screened by a standard of polished ebonite or hard wood. By this device the balance and its source of illumination are self-contained, and the case may be altered in position at will by merely lengthening the flexible lead or by making connection to another point of the electrical supply.

Experiments indicate that the increase of temperature inside the balance case under normal conditions of weighing by such artificial illumination should not amount to more than 2 or 3° C. Such a variation, when uniform, should not affect the accuracy of an ordinary analytical balance giving trustworthy results over the range of temperature variation experienced in ordinary laboratory practice. Evidence has also been adduced that no disturbance of equilibrium due to uneven heating of the balance arms or air currents need be feared when employing this form of illumination.

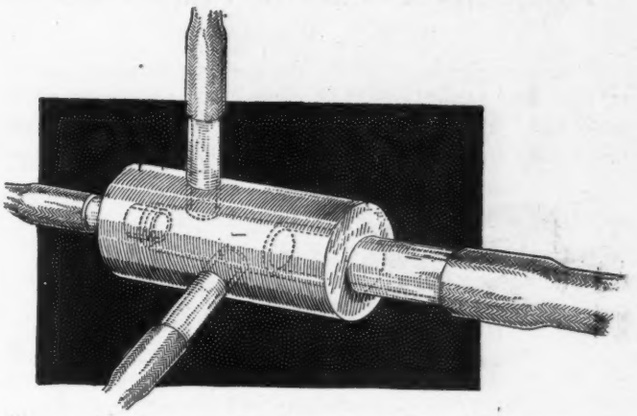
Preventing Hydrogen Sulphide Leaks

A stopcock for controlling the flow of hydrogen sulphide and preventing the gas from leaking is described by Carl H. Classen in *Journ. Ind. and Eng. Chem.* for February, 1918. The device, which is in use at the Rice Institute, Hampton, Tex., is simply a glass "pearl" inserted in a piece of rubber tubing attached to the branch pipe of the hydrogen sulphide main. The glass tubing from which the "pearl" is made should be slightly larger in diameter than the rubber tubing. The "pearl" thus completely chokes the passage in the latter, stopping the flow of the gas. The H_2S can be "turned on" at the will of the operator by squeezing the rubber tubing around the pearl between thumb and forefinger. Thus a small opening between glass and rubber will be formed through which the gas may flow. The opening, of course, disappears as soon as the pressure of the fingers is removed.

An Emergency Laboratory Manifold

By L. D. Lauther

A laboratory manifold which may easily be made for an emergency is shown in the illustration. The device comprises a cylindrical rubber stopper, through the center of which a hole is bored by means of a cork drill, short pieces of glass tube being inserted at each end.



EASILY MADE AND INEXPENSIVE LABORATORY MANIFOLD

As many more holes are drilled into the side of the stopper, connecting with the central hole, as are required for the manifold. Each hole is fitted in the same way with a glass tube; thus the glass tubes are all connected by rubber tubing. They may be made at small cost.

Modification of Benzol Method For Water Determination in Mineral Oils

By F. C. Fuchs*

The most accurate methods for the determination of water in mineral oils make use of metallic sodium, calcium carbide, or distillation with a non-miscible liquid, generally xylol, benzol or toluol. The last method, although not so accurate as the others mentioned, is the simplest one, as it requires only a distilling flask, a condenser and a burette for receiving and breaking the distilled emulsion.

In applying the method, in my laboratory at the Lima School of Mines, I found that, even after 24 hrs., drops of water adhering to the walls of the burette remained in suspension in the benzol, and, both liquids being colorless and transparent, small drops of water could not be easily detected. In order to avoid this difficulty and to have a sure means of ascertaining the complete separation of benzol and water, I added a coloring substance, soluble in benzol but insoluble in water, and the suspended colorless drops of water appeared clearly within the colored benzol. By light blows against the walls of the burette, helped by gentle heating, the drops could be forced to descend. At the same time, the reading of the volume of water is more distinct.

After a few experiments with different coloring substances, I found that the most suitable one was natural asphalt. A concentrated solution of this substance in benzol is prepared and kept tightly stoppered. One or two cubic centimeters are used for each determination.

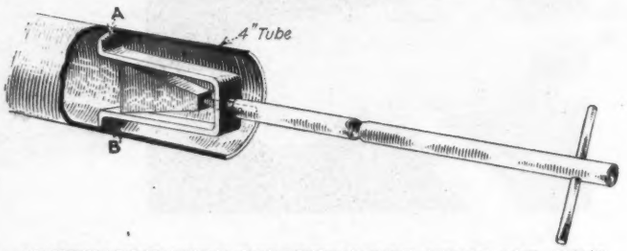
*Lima School of Mines, Lima, Peru.

Practical Suggestions

Home-Made Tube or Flue Scraper

By H. C. Williams*

There are plenty of good tube and flue scrapers on the market, but sometimes it is convenient or necessary to make one. Take an old 18-in. file, cut the tang and draw down each end and bend at right angles. Drill or punch



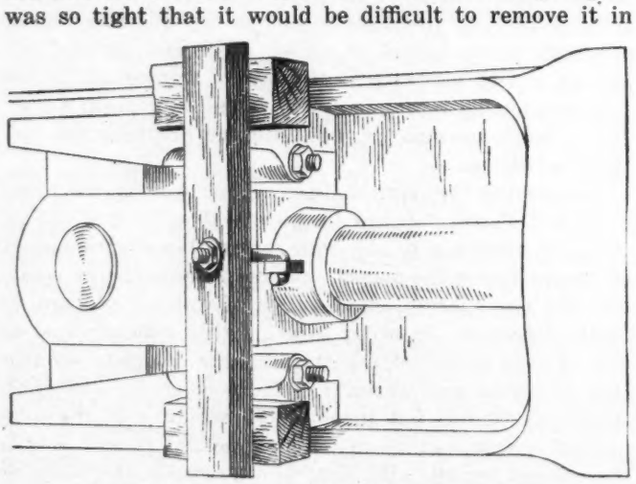
ADJUSTABLE TUBE SCRAPER MADE FROM OLD FILE

a ⅝-in. hole through the middle, then bend to the shape shown. Grind the cutting edges *A* and *B* to the angle desired. Provide a wedge for adjusting the size, to make the scraper fit the tube, with the round part threaded for ⅝-in. nuts and also as a means for attaching the handle, which can easily be made of pipe. When the scraper gets dull, it must be ground and the wedge adjusted again.

Drawing a Tight Key

By Jack L. Ball†

It was found that the key used to fasten the piston rod into the crosshead of an 18 x 32-in. hoisting engine was so tight that it would be difficult to remove it in



HOOK BOLT PULLING ON A TIGHT KEY

limited time. A ratchet was secured and a ¾-in. hole drilled in the key; a ¾-in. bolt was heated, bent and extended through a piece of 2-in. square iron blocked in the position shown in the illustration. After drawing up very tight on the nut, a light tap with a hammer loosened the key.

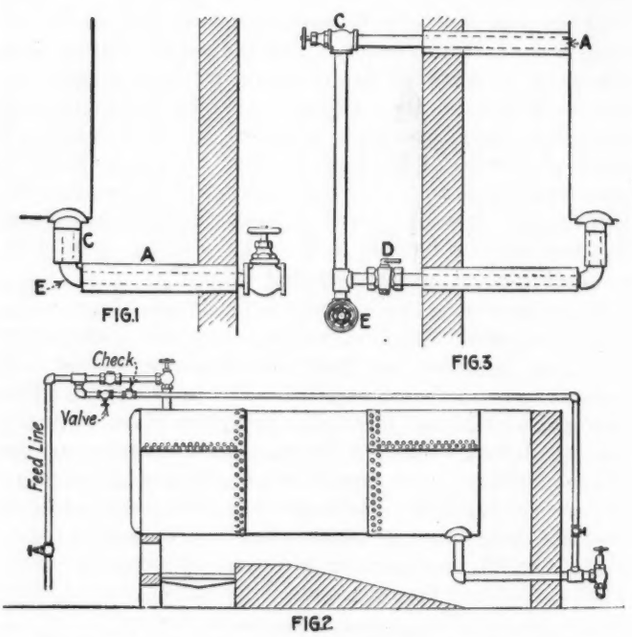
*Concord, New Hampshire.
†Amsterdam, Ohio.

Blowoff Failure and Remedy

By P. E. Merriam*

The blowoff valves on a battery of boilers were originally arranged as shown in Fig. 1, the part of the 2½-in. blowoff pipe in the combustion chamber being protected by a long sleeve *A* extending through the back wall, and the vertical sleeve *C* and the elbow *E* being covered 2 in. thick with magnesia mixed with high-temperature cement.

Although the boilers were worked above rating, no trouble was experienced until underfeed stokers were installed. After the first had been in operation a month, the blowoff pipe was burned and ruptured inside the setting. This was replaced, using extra-heavy pipe and



FIGS. 1 TO 3. PROTECTION FOR BLOWOFF PIPE
Fig. 1—Original piping. Fig. 2—Circulating pipe connected. Fig. 3—Another plan.

fittings. In a short time after the second stoker was in operation, the blowoff pipe on that boiler failed as had the first. The engineer decided that the intense heat in the combustion chamber evaporated the water in the pipe so fast that none remained to protect the pipe, and accordingly he changed them all by placing a tee in the feed line to each boiler and extending a small pipe to the blowoff, as shown in Fig. 2. This causes a circulation through the blowoff pipe, and in three years no further trouble has developed.

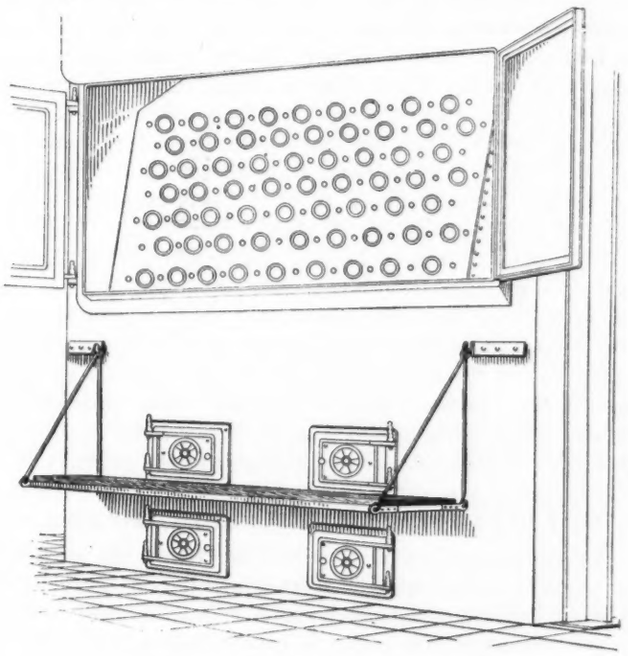
Fig. 3 shows another way to keep the blowoff pipe clear and gives good results. The pipe *A* is tapped into the back head at the water line and is protected in the combustion chamber by a sleeve and connects with the

*Methuen, Massachusetts.

blowoff pipe outside of the setting, as shown. When the boiler is to be blown down, valve *C* is closed and *D* and *E* are opened. When desirable to flush the pipe *A* or use it as a surface blowoff, *D* is closed and *C* and *E* are opened. Under operating conditions valves *C* and *D* are open and *E* is closed.

Portable Boiler-Cleaning Platform

It is common to see a fireman balanced on a box placed in front of a boiler, while washing out and doing other work during the cleaning-out period. The illustration shows a convenient portable platform that can be used with good results and can be made by any one. The sketch shows the platform hung in front of a boiler. It consists of a wooden frame on which lengthwise strips are secured. At each corner is a flat strip of iron, with an eyepiece on one end, and secured in place with small



CLEANING PLATFORM IN POSITION

bolts. On the front of the boiler are two flat iron pieces with a hook on the inner end. From these hooks, ⅜-in. rods hang and hook onto the eyepieces of the platform. It requires but a minute to put the platform in place, and it is as easily removed.

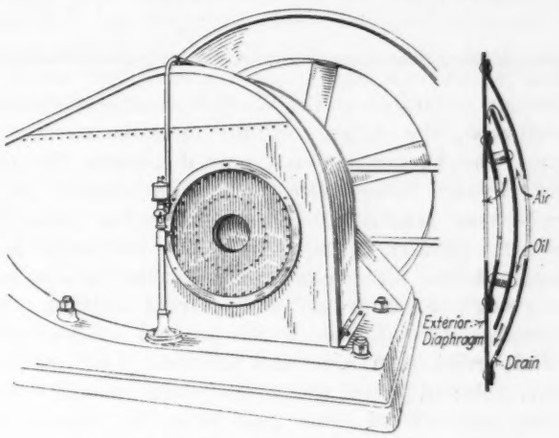
A Satisfactory Oil Guard

By F. L. Johnson*

In a power plant with high-speed engines the cranks of which were inclosed in sheet-iron cases, a 20-in. opening was left opposite the forward crank center to give access to the rod end for keying.

To keep the oil from splashing out on the floor, the engine builders covered the opening with a fine-mesh screen.

As an oil guard it was an unsatisfactory arrangement, as the pulsations of air acting on the screen distorted it, and as it flapped back and forth oil was thrown off, much of which went to the floor. Transverse braces were put on to stiffen it, but with no great success. After some thought a modified form of exhaust head was made of



DETAILS OF OIL GUARD

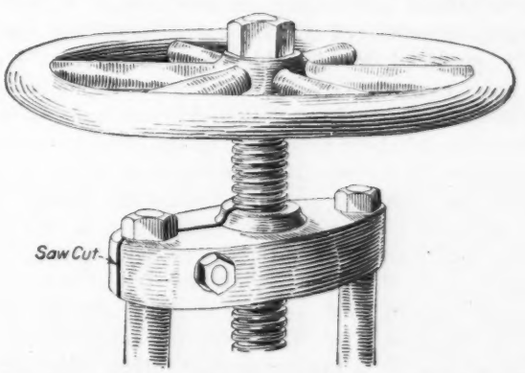
No. 16 sheet iron and put over the opening as an experiment by one of the mechanics in the plant.

The sketch shows how it was made and attached to the case, and the certainty with which it stopped all throwing of oil and still gave perfect ventilation was highly satisfactory.

Freeing Threads on Valve Stems

By H. C. Williams*

In many plants there are valves that are used only once in a while, and when they are needed their stem threads will sometimes stick or work stiff. I had such a case recently, and in trying to open the valve, I twisted the stem off. To prevent a recurrence, I split one side of the yoke with a hacksaw and drilled it to receive a bolt, as shown in the illustration, putting in a strip of sheet



SLOTTED YOKE ON INFREQUENTLY USED VALVES

iron to fill the split when tightening up the bolt. The stem can easily be freed by slacking the bolt and striking the yoke a few blows, and the yoke is not weakened, as the bolt takes away any strain there may be. For yokes that will not permit of splitting as shown, it is best to cut a slot in the shape of a keyway on one side of the stem through the threaded part, so as to act as a cleaner for any dirt or grit. I have several valve stems fixed that way, and they work well.

*New York City.

*Concord, New Hampshire.

Events and Economics of the War

German resistance on the Western front is stiffening; nevertheless, the Allies continue to make substantial gains. The French advance now dominates the Oise valley; French forces have captured Ribecourt. Allied patrols have penetrated Albert, and other gains are reported. Cavalry is in action. The Bolsheviki have released Allied diplomats. The Czecho-Slovaks have been recognized as a nation by Great Britain. The American consul at Moscow has severed relations with the Bolsheviki. An American regiment has landed at Vladivostok and joined the Allied troops already there; the Japanese arrived later. Bolsheviki forces have been driven 100 miles from Archangel, and Allied forces landed at Onega Bay. One British force has reached Baku and has seized that oil port on the Caspian Sea, another has penetrated Turkestan and joined forces with the anti-Bolsheviki.

An agreement is in process of conclusion with regard to 80% war-profits tax. One hundred members of the I. W. W. organization were found guilty on numerous charges.

Domestic Crucible Graphite Insufficient

It is estimated that with the increased requirements in manufacture of munitions and in kindred industries, about 25,000 tons of graphite, suitable for manufacture of crucibles, will be needed in 1918, states a U. S. Geological Survey authority. If freight conditions and demand for the product favor the production of domestic graphite, about 8000 tons of flake, exclusive of dust, can be produced in this country. This will mean an increase of about 160% over the production in 1917 and is largely in excess of the amount of domestic material usually required by crucible manufacturers. Unless they should use a larger proportion of the domestic product than formerly, many mills may have difficulty in disposing of their product. If the freight situation should revert to the conditions prevailing in the autumn of 1917, and imported graphite enters the market in as large amounts as during the latter part of 1917 and the first few months of 1918, the demand will be small and the domestic production of No. 1 and No. 2 flake will hardly exceed 2500 tons. If the domestic production could be stimulated to its maximum capacity, reasonable assurance of a steady market given, and encouragement offered for the establishment and operation of new plants, a production as high as 10,000 tons might be reached. In any case it is evident that the country is not yet independent with respect to graphite suitable for manufacture of crucibles, and the deficiency must be supplied from Ceylon and Madagascar.

Although the War Trade Board's restriction has been a factor in reducing imports, there was a lessened demand for Ceylon graphite several months previous to the restriction becoming effective, according to a consular report. The plumbago shipped to the United States from Ceylon during the quarter ended Mar. 31, 1918, totaled only 2194 tons, valued at $405,064, according to certified consular invoices, as against 6524 tons, valued at $2,166,957, in the same quarter in 1917.

In 1917 the United States took over 81% of Ceylon's graphite production, as compared with 75% in 1916. Though the best grades of plumbago sold for as high as $500 per ton during 1916 and 1917, half this price is not obtainable at present.

Government Standardizes Price of Silver

The Treasury recently fixed the maximum price of silver at $1.01½ per fine ounce. As the United States supplies most of the metal, this decision amounts to the establishment of a definite world price, additional guarantee being afforded by the fact that one condition attending the sale of silver by the Government is that the purchaser shall not pay more than the standard price of $1.01½ in markets outside the United States.

Within the last three months the Government has melted down about 100,000,000 silver dollars and exported most of the bullion to India, China, and Japan for coinage purposes. As the law under which this was done specifies that the Government shall pay $1 per oz. for silver to replace these melted dollars, the Government found it necessary to sell its own stocks at 1½c. above the purchase price. Recently some purchasers have been bidding as much as $1.02 for silver to be exported, necessitating action to stabilize the price.

Tin Among the Precious Metals

Recent quotations of $1 per lb. for tin in the markets of New York suggest that this metal, for which the United States is dependent upon mines in other countries, may soon rank as a precious metal, says a bulletin of the National City Bank.

Tin mined in the islands of Banca, just off the coast of Java, has been reaching the United States lately across the Pacific, and not through the Mediterranean, as under normal conditions. This is also true of part of the tin from the Malay Peninsula and the small quantity of tin from the mines in China, which are at the present time isolated from the market on account of floods which prevent transportation to the Hongkong smelteries.

The United States is dependent in large part upon the mines on the opposite side of the globe, though considerable quantities are now being drawn from our South American neighbor, Bolivia, which produces nearly one-third of the tin used in the world, but exports it as concentrates, owing to lack of fuel for use in smelting.

All efforts to develop tin production in the United States, which now uses about one-half of the tin mined in the world, have thus far been unsuccessful. The extremely small quantities found in Alaska and other parts of the country have been insufficient to supply even 1% of the steadily increasing quantity required by our industries.

Sheet Mica Production Stimulated By War Demands

The quantity of sheet mica produced and sold in 1917 showed an increase of 41% over that of 1916, being 1,216,816 lb., as compared with 865,863 lb. in 1916 and 553,821 lb. in 1915, according to a bulletin of the U. S. Geological Survey.

The prices paid for mica in 1917 continued, with minor fluctuations, to increase throughout the year. Those for domestic mica in the South in 1917 were from 10 to 20% higher than the prices for similar mica in 1916. The greatest increase was for the smaller sizes, especially for the 1½ by 2, 2 by 2, and 2 by 3 in. The largest sizes showed no increase in price. The average price per lb. of sheet mica produced in 1917 was 58c., a price lower than for either 1916 (61c.) or 1915 (68c.) but higher than for any other preceding year.

Sheet mica has come to be of importance as a war mineral through its use as insulator in electric apparatus, especially in condensers, magnetos, and spark plugs; also as windows in masks worn for defense against asphyxiating gases, and for other uses where a transparent, non-inflammable, non-shattering material is necessary, as in automobile goggles and as coverings for wounds. It is also used in spectacles, sight holes of divers' helmets and smoke helmets, compass cards, automobile shields, and in windows where glass would be broken by heavy shocks or by vibrations, as in the conning towers of warships and of submarines. That ground mica is possibly of value as a chemical source of potash salts has been suggested, especially its direct application to the soil as a fertilizer.

Argentina To Build Merchant Fleet

Reports from Buenos Aires indicate the probability that Argentina will make appreciable additions to her merchant marine as soon as opportunity permits. The Argentine Navigation Co. will begin building soon, for local service; and will subsequently add about 100,000 tons to the present fleet. The new ships will vary in size from 1000 to 4000 tons, and will be used mainly as a result of an anticipated increase in commercial intercourse between Argentina and the United States and Europe after the war. The additional shipping facilities will aid immigration, which is to be encouraged, particularly of European war veterans.

In connection with the policy of expansion, it has been suggested that Argentina should establish a Latin-American Chamber of Commerce in New York to coöperate with a branch in Buenos Aires.

Appeal Made to Patriotism Of Coal Workers

The anthracite industry is thoroughly in accord with a plan which is being put into practice by James B. Neale, director of production of the U. S. Fuel Administration. A committee of six men is to be appointed, to be known as the production committee, three of whom will represent the operators and three the mine workers. This committee's duty will be to see that every worker is American in thought, word and deed, and that he will work eight hours daily for six days a week. There will also be a producing manager appointed by the Fuel Administration for each coal-producing district. His duty will be to stimulate patriotism and arrange meetings, at which loyalty will be the keynote. The nation's needs will be discussed, and intensive methods for greater output will be outlined. This plan is designed to combat the German propaganda now being waged in the anthracite region.

Export of Gold Manufactures Limited

Exportation of manufactures of gold, it was announced by the War Trade Board on July 29, would not be permitted under license on and after that date, unless satisfactory evidence were given that the f.o.b. selling price of the articles, which include jewelry, watches, plate, and like products, was not less than three times the value of the fine gold contained. However, if articles of the sort named were actually made for the sole purpose of export before July 29, they may be exported up to Sept. 1, 1918, provided the f.o.b. selling price is not less than twice the value of the fine gold contents. Applications to export manufactures containing platinum, iridium, gold or palladium will be considered only when regulations governing the export of the latter metals have been complied with.

Fabrication of Rivetless Ships

News has been received of the launching of the first steel vessel built without rivets, in Great Britain. Electric welding took the place of riveting, the plates being bolted together temporarily during the process.

Although spot welding has been used extensively as an alternative to riveting light iron and steel, and other processes of welding have been adopted in subsidiary construction work in shipbuilding, this is the first instance of a completed vessel being fabricated entirely by welding. From the data obtained during the construction of the new ship, the admiralty estimates that a saving of 25% may be made in the principal costs of construction.

Bureau of Mines Coöperates With Food Administration

It is seldom realized that flour has hitherto been used extensively in the manufacture of dynamite and other explosives, and coöperation between the Bureau of Mines and the Food Administration has resulted in the conviction that more than 16,000 barrels of flour per annum can be saved as a result of the action of the Bureau in seeing that manufacturers use substitutes wherever possible. Wheat flour is also used in small quantities in assaying; and it is interesting to note that the food conservation campaign in South Africa led to the substitution of mealie flour for this purpose, the alternative reducer proving entirely satisfactory.

The awarding of a War Industries Badge as an insignia of merit to deserving industrial workers has been authorized by Secretary of Labor Wilson, on the recommendation of the War Labor Policies Board and following an agreement between the war production departments of the Government.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Platinum: Its Licensing Here And Production in Colombia

Regulations concerning the licensing of those handling platinum have been drafted by a committee composed of Hennen Jennings, Charles H. Conner, Charles L. Parsons and James H. Hill. The regulations now go to the Secretary of the Interior and to the chairman of the War Industries Board for approval, after which they will be duly promulgated. Rumors continue to reach Washington that considerable quantities of platinum are being withheld from the market in Colombia. To date, however, no evidence in substantiation of the reports has been forthcoming. From present indications it is probable that Colombia will produce 35,000 ounces of crude platinum during the current year. A slight increase in the 1918 domestic (U. S.) production is expected by platinum specialists here.

Output of Chrome To Be Augmented

Concentrating tests are being made of chrome ores at the Seattle station of the Bureau of Mines. Under the direction of Albert Burch, the Bureau is making special efforts to be helpful to the producers of northern California and southern Oregon, who at short notice have been called upon to furnish the chrome needs of the country. Just at this time, special attention is being given to deposits away from the railroads. The Bureau's field men are estimating costs and studying the economic situation of such deposits, with the intention of designating those which offer the best chance to become producers. Experimentation also is in progress with regard to the best method of getting chrome from beach sands.

Suspension of Recruiting for Officers' Training Camps

Volunteering of men in civil life for training as officers is suspended in order to prevent disruption of industry and the general impairment of efficiency which results from the indiscriminate enlistment of men up to the age of 45. The new order will remain in force until pending draft-law legislation is passed and new regulations are decided upon which will determine the most suitable form of selection. It is probable that the final regulations in the matter will leave it to the Government to decide whether men can be spared from certain occupations for military service.

Priorities Board To Encourage Gold Mining

That Washington is aroused thoroughly to the need of stimulating gold production is evidenced by a resolution passed last week by the Priorities Board. The resolution reads: "Be it resolved by the Priorities Board that gold mining is an essential war industry, and the powers of this board will be so exercised as to accord to such industry preferential treatment in the supply not only of tools, machinery and equipment, but in transportation service, fuel supply and labor supply."

Apparently it is the consensus of opinion in Washington that a bonus on gold production, or any other similar panacea, is impracticable. It is believed, however, that numerous minor ways of assisting the industry can be found, which, in the aggregate, will result in stimulating the output.

Zinc Production Stimulated By Increased Demand

Reports to the War Industries Board indicate marked increases in the production of zinc, not only for war needs but for commercial purposes. The board is encouraged by the increased use of zinc in substitution for more needed metals. The enameling of sheet zinc by refrigerator manufacturers apparently is proceeding successfully, as large amounts of zinc are now being used for this purpose. Numerous architects are advising the use of zinc for flashing and spouting in building construction. The New Jersey Zinc Co. is featuring an extended use of zinc in new buildings which it has under construction.

A reduction of 20% in the rates on manganese ore from Western producing fields to Eastern manufacturing centers has been ordered by the Railroad Administration. The Alaskan Steamship Co. and the Pacific Steamship Co. have been given authority to establish rates on ore and concentrates dependent upon their value. The rates, however, are to apply only to such ores and concentrates the value of which does not exceed $50 per ton.

Consideration is being given by Pope Yeatman, head of the non-ferrous metals section of the War Industries Board, to the applications for relief from the copper consumers who had signed contracts based on the 23½c. price. Every effort is being made to find a way to be helpful to those really entitled to relief.

A new system of control in the procurement of all war materials has been announced by the War Department. It provides for a review of every contract by boards of control, the centralizing of purchases, the standardization of contract clauses, a daily fiscal survey and provisions for public information on War Department needs.

To meet a request from district and local draft boards, the Bureau of Mines is hurrying work on its glossary of mining terms. There is also a demand for information from officials engaged in the classification of the personnel of the Army, who need dictionaries of terms relating to industrial occupations.

Monthly Copper Production for 1918

This table is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the U. S. Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Canada Copper, Granby, Cananea, Braden, Cerro de Pasco and Chile. As a matter of record, however, the individual figures are given after the total. We also report the production of the Boleo and Katanga companies, whose copper does not come to the United States.

MONTHLY CRUDE COPPER PRODUCTION, 1918

	April	May	June	July
Alaska shipments	3,579,920	6,069,642	3,980,197	3,994,204
Arizona:				
Arizona Copper	4,200,000	4,130,000	3,700,000	4,000,000
Cons. Ariz. Smelting	2,000,000	2,000,000	1,750,000	1,430,000
Inspiration	9,350,000	10,250,000	10,300,000	9,000,000
Magma	1,050,000	1,169,083	947,128	800,000
Miami	4,913,590	5,100,408	4,692,554	4,793,082
New Cornelia (*a*)	2,806,000	2,880,000	2,822,000	2,300,000
Old Dominion	2,814,000	3,239,000	3,368,000	2,533,000
Ray	7,350,000	8,120,000	7,736,559	7,300,000
Shannon	827,000	802,000	672,000	794,225
Shattuck Arizona	842,790	840,999	805,310	672,024
Other Arizona	25,007,820	27,491,118	25,823,920	24,727,751
California:				
Mammoth	1,530,000	1,328,000	1,196,000	1,330,000
Michigan:				
Calumet & Hecla	11,734,820	12,944,732	11,699,212	11,118,426
Other Lake Superior (*b*)	7,000,000	7,000,000	7,000,000	7,000,000
Montana:				
Anaconda	26,500,000	28,400,000	25,800,000	25,400,000
East Butte	1,811,360	2,208,300	1,999,760	2,076,460
Nevada:				
Mason Valley	1,058,400	1,759,728	1,224,485	1,190,177
Nevada Cons.	6,900,000	7,000,000	7,250,000	6,400,090
New Mexico:				
Chino	6,290,513	5,987,340	6,706,474	6,310,396
Utah:				
Utah Copper	16,690,883	18,200,000	18,500,000	16,021,766
Eastern smelters (*b*)	1,750,000	1,750,000	1,750,000	1,750,000
Total reported	146,007,096	158,670,350	149,723,559	.....
Others, estimated	17,200,000	22,400,000	17,000,000	.....
Total United States	163,207,096	181,070,350	166,723,559	.....
Imports, ore and concentrates, etc.	12,047,453	10,886,293	11,624,275	.....
Imports in blister, etc.	31,294,232	27,892,478	13,801,332	.....
Grand total	206,548,781	219,849,121	192,149,166	.....
British Columbia:				
Granby Cons.	3,689,982	3,808,125	3,438,521	2,167,077
Mexico:				
Boleo	1,818,880	1,873,760	1,322,720	.....
Cananea	4,100,000	4,100,000	4,100,000	5,000,000
Other Foreign:				
Braden	4,722,000	6,758,000	8,292,000	7,036,000
Cerro de Pasco	5,952,000	6,166,000	5,874,000	5,238,000
Chile	7,770,000	7,506,000	9,280,000	.....
Katanga	4,695,798	5,180,810	3,505,315	.....

(*a*) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery, which is included under "Other Arizona." (*b*) Estimated.

The production of the United States by months since the beginning of the year was as follows:

	1918
January	165,431,568
February	160,011,364
March	185,525,168
April	163,207,096
May	181,070,350
June	166,723,559

The item "Alaska shipments" gives the official figure of the U. S. Department of Commerce. Kennecott production for April, May, June and July was 4,794,000, 3,404,000, 4,044,000 and 5,090,000 lb., respectively.

It's a Long Way to Tipperary

Just suppose that your office or home was transferred, for a moment, to alongside a lonely road in France, and that as you looked out of the window you saw a company of the 27th Engineers coming back from the firing line—from the incessant din and danger and eternal vigilance—back for a few hours of well-earned rest. Wouldn't you feel glad of an opportunity to cheer them up? Those half dozen cigars in your pocket—how long would they last if you had the opportunity of handing them over to the men who are doing so much to make the world a decent place to live in?

But France is a long way off, and it is just the distance that makes it more difficult for us to realize what is going on. Picture those men tramping back to their billets—and then send your check to the Comfort Fund, and take your share of credit for that smile of satisfaction—that won't wear off.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$13,664.00
Students of Wisconsin Mining School	50.00
A. M. Plumb	5.00
C. W. Snow	2.50
Charles A. Mitke	5.00
A. A. Hassan	10.00
A. A. Hassan, Jr.	5.00
Emin A. Hassan	5.00
Bernard MacDonald	5.00
C. F. Rand	50.00
Calumet & Arizona Mining Co. and New Cornelia Copper Co.	400.00
Oscar Lachmund (fourth contribution)	10.00
C. N. Bell	10.00
C. S. Witherell	25.00
W. G. McBride	25.00
Karl Eilers	50.00
R. T. Hancock	5.00
E. E. White	100.00
S. Ringlund	10.00
H. Foster Bain	10.00
Marc Bailey	10.00
Charles Le Vasseur (second contribution)	10.00
William Wraith	25.00
H. A. Wheeler	10.00
Nevada Mine Operators' Association	100.00
Louis R. Wallace	50.00
H. P. Bowen	5.00
H. L. Brown and M. W. Hayward	16.00
Iron Cap Copper Co.	50.00
W. N. Smith	10.00
E. S. Geary	5.00
H. J. Wolf	10.00
F. H. Siebold	10.00
H. A. Kee	10.00
W. S. Grether	5.00
Marion J. Thomas	10.00
E. F. Eurich	10.00
Liberty Bell Gold Mining Co.	200.00
H. De Witt Smith	15.00
Associated Miners of the University of Idaho	10.00
New Idria Quicksilver Mining Co.	100.00
F. P. Burrall	25.00
Livingston Wernecke	5.00
E. P. Mathewson	50.00
Interest to June 26	82.61
H. W. Hixon	10.00
R. C. Canby	10.00
S. R. Guggenheim	100.00
Richard Tavis	5.00
Simon Guggenheim	100.00
J. V. Kelley	10.00
Algernon Del Mar	4.00
Sumner S. Smith	5.00
Will H. Coghill	10.00
Lincoln Crocker	10.00
C. E. Dewey	10.00
Plymouth Consolidated Gold Mines, Ltd.	100.00
United Eastern Mining Co.	50.00
W. A. Wilson	20.00
Oscar Lachmund (fifth contribution)	10.00
W. Rowland Cox	10.00
L. D. Huntoon	5.00
Alaska Mining and Engineering Society	50.00
W. R. Benedict	3.00
Etheredge Walker	25.00
Fritz Mella	10.00
Richard McCarthy	10.00
J. N. Houser	10.00
Weedon Mining Co.	50.00
Wm. H. Kinnon	30.00
A. P. O'Brien	10.00
Lester W. Strauss	10.00
Montana Society of Engineers	50.00
W. R. Atkeson	2.50
Charles Le Vasseur (third contribution)	5.00
Frank Carroll	10.00
V. P. Hastings, Jr.	5.00
D. E. Woodbridge	5.00
Harvey B. Small	10.00
J. C. Porter	10.00
Total	$16,054.61

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers.

Growth of the Mining and Metal Industries in France*

One of the most important questions which at the outset of the war engaged the attention of those who were entrusted with the safety and welfare of France, was the supply of cast iron and steel. When enormous quantities of these metals were needed for the manufacture of war material, France, owing to the German invasion, was deprived of her most important fields of iron ore, as well as the chief foundries for transforming this ore into metal. The North African mines were immediately requisitioned. Iron ore was purchased from Spain, steel from America and England. The foundries which had been closed since August, 1914, were opened again by degrees—even those in the proximity of the front, such as the Neuves-Maisons, Frouard and Pompey. Many glass-works furnaces were adapted for metallurgy; and the great mineral wealth which till then had been turned to little account was exploited. The results of these efforts soon made themselves felt. Before the war, of the 5,000,000 tons of coke required every year, France had to get more than 2,000,000 tons from Germany. At the present time she can supply her own needs, and does not require to apply abroad for any coke. Supposing 100 is taken as representing the output of cast iron in September, 1915, it will be found that the factor rose progressively to 176 (in January, 1916), 250 (July, 1916), and to 280 (in January, 1917). For steel the same progression is noticeable. If the production of Martin and ordinary steel is represented by 100 for January, 1915, it has now reached 155 for Martin and 210 for ordinary steel.

It is in Normandy that the efforts, not only for exploiting mineral wealth but also for giving greater extension to the metallurgic output of France, have been greatest and far reaching; and they promise well for the future. Before the war, France was considered as rich in iron ore. Besides the basins of Lorraine, which produce three milliard tons, she possesses the basin of Normandy, which, in an area of 40,000 sq.km., contains, according to a recent estimate, nearly a milliard tons of a superior quality of ore yielding 50% of iron. In 1914, 21 grants in mining districts, producing 1,152,000 tons a year, already existed in the departments of the Orne, Manche and Calvados, which yielded 648,000 tons, with six grants only under exploitation. About the middle of 1916, a large society, entirely French, the Société Normande de Métallurgie, was founded, with a capital of 40,000,000 fr., by Schneider and Co., the great Creusot manufacturers, the Société des Aciéries de la Marine et Homécourt, and several shareholders belonging to the metallurgic world. This new society leased the foundry previously organized by the Société des Hauts-Fourneaux de Caen, formed in 1892; and in July, 1916, started the works afresh. They are situated at Mondeville-Colombelle near Caen, and cover over 400 hectares (a hectare is about 2½ acres), 200 of which are on the plateau and 200 in the valley of the Orne. About 30 km. distant is the Soumont mine, capable of yielding even now 4000 tons of iron ore a month, and which, in the near future, will have a far larger output.

The establishments of the Société Normande de Métallurgie comprise gas and coke furnaces, large steel works, a rolling mill, smelting works, and blast furnaces. Three stations and a railway line 33 km. long facilitate the transport service. The line was made by a branch society and runs between the foundries and the Soumont mines. There are now four batteries of 42 furnaces each, producing 1000 tons of coke a day. Since January, 1918, two other batteries have been in working order and have brought the output up to 1500 tons a day, or 500,000 tons a year. The coke, collected by an ingenious system of inclined planes and chains, after being sorted out is sent in trucks to government metal works. Gas undergoes a series of processes for the purpose of extracting the byproducts obtained by the distillation of coal, such as tar, phenol, benzine, toluol, naphthalin, sulphate of ammonia, used in the manufacture of explosives and for dyeing purposes, and which, prior to the war, were almost exclusively produced by Germany.

The blast furnaces, the first of which has been recently blown in, are in themselves 29 m. high, but with their basements tower 45 m. above the foundry ground plot. They can produce 400 tons a day, which is the largest individual output obtained in Europe at present. To each is affixed a battery of five metal cylinders, or "Cowpers," 7 in. in diameter, for heating the air. Three of these gigantic blast furnaces will be ready this fall; and the whole installation, when completed, will be capable of an output of 450,000 tons of cast iron a year. The steel works contain four converters of 30 tons' capacity and five Martin furnaces of 30 tons' capacity, capable of producing an output of 275,000 tons of Thomas steel and 125,000 tons of Martin steel annually. The rolling mill can pass 500,000 tons of ingots a year, and is supplied with several reversible trains for production of small samples. The Société already possesses ample stocks of iron ore; also a large water tower, 66 m. high, built in the neighborhood, with two reservoirs and a canal to the Orne, so that 10,000 cu.m. of water could be supplied hourly. A vast hall, 200 m. long, contains the electrical equipment, consisting of two turbo alternating-current generators of 3000 and 5000 kw., six gas alternating-current generators of 6000 hp., and three of 3000 hp. A private harbor has been built on the Orne canal, and it is ready for vessels of 2000 tons, and will soon be open to boats of 8000 tons' burden.

The preceding facts show how the Société Normande has been able to create, in the midst of war, one of the most important metallurgic centers in the whole of France. The mining industry of the entire region has followed its example. At present 30 fresh grants have been made for exploiting deposits in Normandy, Brittany and Anjou. On the other hand, the French government is preparing to work the Littry coal fields, situated between Saint-Lo and Bayeaux. Lastly, owing to many recent improvements, trade with Caen harbor is increasing every day. From 890,000 tons in 1910, it rose to 1,126,000 in 1913. The canal connecting the harbor with the sea will soon be enlarged and made accessible to vessels of 8000 tons. All Western France is participating in this mining and industrial expansion occasioned by the war. It is also purposed to build new blast furnaces in the neighborhood of Rouen.

*Excerpt from the Fortnightly Information Leaflet issued by the American Chamber of Commerce in Paris.

Editorials

Work or Fight

WE FIND it hard to understand the opposition of Mr. Gompers and the other conservative labor leaders to the "work-or-fight" provision in the pending draft bill. This provides simply that if a man be absent from work without cause for more than a very reasonable—indeed, very lenient—time, he may be withdrawn from a deferred classification and thus rendered liable to draft. The labor leaders protest that this is an attack upon the loyalty of the American workman and a "conscription of labor in a covert way." "Labor has kept faith," says Frank Morrison, secretary of the American Federation of Labor. "If enacted, the amendment would be used by every unfair profiteering employer. We protest against placing an employer in a position to brand his employees as 'slackers.'"

Now, the purpose of the amendment, without any doubt, is to cause all men to work full time, or something that is more nearly so than they do at present. The labor leaders imply that their men are working even now as much as the proposed law requires, and they say specifically that the men are neither "slackers" nor disloyal. If this be so, we cannot see what valid objection they can have to the provision, which would be absolutely inoperative with such a condition. If a man is working six days a week in an essential industry, certainly he is not going to be taken away from it.

But we know that in a great many industries the men are absenting themselves from work too much of the time, and this is a very serious matter. Such men may be technically called "slackers," but they are not necessarily disloyal. On the contrary, they may be perfectly loyal and even enthusiastic for the national cause, but they may not be appreciative of what is meant by every man "doing his bit" and may not understand that work in the shops, fields and mines is just as important as direct military service. With men who cannot be made to understand that, some compulsion is necessary. The idea is not to compel them to work for nothing, to enslave themselves; on the contrary, it is simply to compel them to work for the highest wages that ever befell labor in the history of the world.

The slur upon profiteering employers is unjust. There are many honest people who are convinced that the real profiteers in this war are the artisans, mechanics and manual laborers generally. Not only do they squander their extraordinary earnings, but, also, they waste their time, being satisfied too often with the proceeds of two-thirds of a week's work. This is one of the basic causes of increasing costs, increasing wages, increasing costs again, and so on with the vicious circle. Is it that more days of work would tend to reverse these evil conditions, by checking rising wages in the first place, and that in this idea we are to find the real reason for the labor leaders' opposition to the "work-or-fight" proposition? Such a thought would be unworthy of Mr. Gompers, we should say. But if it be entertained by any of his colleagues, let them be assured that there was never anything more economically unsound and dangerous.

Exit the I. W. W.

THE conviction of Haywood and his sub-leaders in the I. W. W. will inspire courage in every loyal heart. The I. W. W. in the United States and the Bolsheviki in Russia are exactly equivalent in their composition and purposes. We have seen the tragedy that has happened in Russia from the Bolsheviki gaining the upper band and setting up a tyranny of their own. Our I. W. W. would have liked to be the same thing here. Already outrageous of our civilization before the war, they extended their nefarious preachings and practices during our time of trouble so that they became disloyal and seditious, playing purposely into the hands of the enemy, just as did Lenine and Trotzky in Russia. For this they were apprehended and locked up, so that they could do no further harm, unless a jury should decide that they had been charged unjustly. Like other citizens, they had their day in court, which in their case happened to be three months. They were tried by a fair-minded jury, in whose selection they participated, according to our ancient and honorable method. The jury promptly decided that they were guilty, and millions of loyal citizens applauded the verdict. Thank God that this country has not been so debauched and poisoned that it is ready for any I. W. W. or Bolsheviki propaganda!

Mr. McAdoo on Taxation

MR. McADOO talked some good sense to the Committee on Ways and Means on Aug. 14. As is well known, that committee had been framing a tax law on the basis of what Mr. Kitchin is pleased to describe as the "excess profits" of capital, that is, on the theory that capital should substantially be limited to a certain arbitrary return. This not only introduces the insolvable complication of what is capital, or, rather, how it should be defined in a law, but also it courts the danger of extinguishing enterprise and reducing our business to a dead level of mediocrity. Mr. McAdoo put his finger right on the line of cleavage when he said:

> The distinction between a war-profits tax and the excess-profits tax is not a matter of form, but of substance. By a war-profits tax we mean a tax upon profits in excess of those realized before the war. By an excess-profits tax we mean a tax upon profits in excess of a given return upon capital. The theory of a war-profits tax is to tax profits due to the war. The theory of an excess-profits tax is to tax profits over and above a given return on capital. A war-profits tax finds its sanction in the conviction of all patriotic men of whatever economic or political school, that no one should profit largely by the war. The excess-profits tax must rest upon the wholly indefensible notion that it is a function of taxation to bring all profits down

to one level with relation to the amount of capital invested, and to deprive industry, foresight and sagacity of their fruits. The excess-profits tax exempts capital and burdens brains, ability and energy. The excess-profits tax falls less heavily on big business than on small business, because big business is generally over-capitalized and small businesses are often under-capitalized.

The war-profits tax would tax all war profits at one high rate; the excess-profits tax does, and for safety must, tax all excess profits at lower and graduated rates. Any graduated tax upon corporations is indefensible in theory, for corporations are only aggregations of individuals, and by such a tax the numerous small stockholders of a great corporation may be taxed at a higher rate than the very wealthy large stockholders of a relatively smaller corporation. The object of a graduated tax should be to make taxes fall upon the rich, who are best able to pay them. The graduated excess-profits tax disregards this, and often produces the reverse result.

Mr. McAdoo unfortunately offset to some extent his own sensible expression by advocating a retention of the present excess-profits tax; not that he does not think it cannot be improved, but he is simply opposed to increasing it. Therefore, after having pronounced the system a bad one, for reasons so succinctly and emphatically stated, he proposes, nevertheless, to keep it. In his letter of June 5 he said:

The Government departments, under great pressure, as they are, to get necessary war materials and supplies with the utmost expedition, cannot in the nature of things fix their prices nor guard their contracts in such a way as to avoid the possibility of profiteering. The one sure way is to tax away the excessive profits when they have been realized. I do not say this in a spirit of criticism of the corporations or business men of the country, who have for the most part loyally supported the Government. In entering into war contracts they take grave risks. They are called upon to make vast expenditures of capital for purposes which may prove unproductive after the war. They are not to be blamed in these circumstances for asking for prices and terms which cover those risks. On the other hand, when the risk has been liquidated by proper allowances, and the contract has proved profitable, the Government should take back in taxes all profits above a reasonable reward.

This also is good sense. It may be pointed out, however, that, between the arrangements of fixed prices and the levying of a confiscatory excess tax on capital, nobody can enter upon expenditures of capital for purposes that may prove unproductive after the war. The combination of these restrictive conditions affords no chance for liquidation. There is not enough taxation of the abhorrent *war profits* and there is too much taxation of incomes, not attributable in any way to the war, simply because they are large. There is too much taxation of the bees and not enough on the honey.

Publicity in South American Mining Matters

THE vicissitudes of the average Latin-American mining corporation are illustrated by a short account of the Caylloma mine, published in the present issue. The intrinsic value of the mine may be gaged from the fact that, as recently as 1914, 12,000 oz. of silver per month was being shipped in rich ore, which frequently assayed 300 or 400 oz. per ton.

Company formation, to judge from the information available, seems to have begun in earnest about 1886, after about 250 years of intermittent production. From 1889 to 1900 an equivalent to about half a million American dollars was spent on plant and equipment, but the only successful metallurgical operation in practice at the latter date seems to have been the sorting of high-grade ore for shipment. Further reconstructions for the purpose of raising capital for plant occurred in 1905 and 1913.

In 1907 a new 60-ton concentrating plant was purchased. Six years later there was another company organization, and money was raised for a new mill. This time separate sand and slime cyanide treatment of concentrating-table tailings was arranged for. A satisfactory extraction of silver by leaching of sand had been proved impracticable in Mexico several years previously, so that, assuming that the ore was not abnormal in character, the new installation was not likely to be a success. The new mill was started up in 1916, and a flotation plant was added in 1917 in an effort to improve results. Flotation of silver ores has not met with the unqualified success predicted in some quarters, so that it is yet early to anticipate that the new combination of methods will prove entirely satisfactory. The present year has already seen the forming of a new directorate and the raising of still more capital.

The checkered careers of so many locally controlled Latin-American mines are in no small measure due to their isolation from modern centers of technical progress. A description of practice often adopted under such conditions—away from the searchlight of publicity—may reasonably be discounted as incredible by the engineer in a progressive mining community, and will be viewed with amazement by the visitor. We have before us an account of the operations of a gold mine which failed to pay expenses on a $\frac{3}{4}$ oz. gold ore, and was shut down. In the operation of the plant all the cyanide solution, after passage through the zinc boxes, appears to have been run to waste.

Cuba has already taken the initiative in a campaign to insist on the need for men of high standing and specialized ability in mining engineering work. In a recent issue of the *Boletin de Minas* attention is drawn to the failure to distinguish between the details of mining and other branches of engineering. Examples are cited where, for the most part, negative results have been achieved, and where only by dint of obtaining abnormally favorable prices for the products has it been possible to develop the industry to any appreciable extent, and so to compensate for the enormous sums invested in badly directed undertakings. The Cuban mining authorities are convinced that success is unattainable without the employment of technical advisers whose professional standing is on a par with that of men who have reached high positions elsewhere; and an appeal is made to all interested in Cuban mining to see that confidence in technical advice is placed only in those whose records afford guarantees of capacity and ability.

Cuba's experience has been shared by other Latin-American countries. Sometimes a visitor who boldly claims the title of mining engineer in such places is looked upon as a charlatan and a sharper—a distinction conferred as a result of the misguided efforts of many so-called experts and specialists who have discredited

the industry by shady financial dealings, by a lamentable deficiency in their knowledge of approved methods of operation, and by an absolute ignorance of details of practice. Nothing will help so much to place the industry on a sound basis, and in a position where it may be respected, as greater publicity.

The Public Is Not To Be Damned

THE public in its relations to public services is very apt to receive scurvy treatment. The public is always more or less helpless. It must travel, and usually can travel only by one way. Similarly, is it restricted in its use of the telegraph and telephone, in its relations with the express service, and so on. A famous financier of railways of a generation ago enunciated the principle of "the public be damned," and the idea trickled down naturally from the fountain head of authority to the meanest baggage smasher. The public had rather an uncomfortable time.

But with the broadening of ideas and visions, the thought occurred to some genius that if measures were taken to make the public happy there would be more use of the service to be sold, which would be beneficial to the vendor of the service. In other words, the idea was that the possession of a monopoly did not limit commercial possibilities. Mr. Vail, of the telephone company, was perhaps the first fully to grasp this big idea. He made the telephone service the most satisfactory of all public services. When he reached into the telegraph service he introduced the same benevolent inspiration into it. Among the express companies nobody ever got the idea. When they fell upon evil days, following the establishment of the parcel post, the public felt that they simply got what they deserved. They remained benighted to the end, with never an idea above the notion that it was good business to collect payment at each end.

The railway companies got the idea in different degrees. There were some administrators, like James J. Hill, who really had it; also the Pennsylvania people. There were others who did not really get it, but who were induced by competition to be very good to the public. Every one remembers how polite and agreeable used to be the staffs of the competing lines from Chicago to the Northwest and from Chicago to Denver, from the man who sold tickets and made reservations in the city offices to the rear-end flagman of the train, who did not disdain to answer inquiries. On other roads there was a variety of service. Some was fairly good, without, however, exemplifying the big idea, which really never permeated thoroughly among the railways; some was indifferent, and some continued downright bad; but, on the whole, the public had come during recent years to receive vastly better treatment than in the days when William H. Vanderbilt declared that it simply was to be damned.

However, since the Government has taken over the railways there has been apparently a change. There is no longer any competition, and therefore no inducement to any employee to be good to people beyond what his own good nature may exude. Nor is there any reason to create business. On the contrary, there is a declared desire to discourage it. But the thought of the administration was to discourage it by advanced rates, not by surly treatment on the part of ticket sellers, freight agents, and trainmen. That those folk have been assuming such an attitude is evidenced by Mr. McAdoo's recent order that they must be good.

Certainly the public has every right to expect that they be polite and decent. Heaven knows that railway service is deteriorating enough to make people unhappy without their having to suffer indignities from indifferent and insolent employees. The public has borne, without murmuring, a staggering increase in rates, which were raised chiefly for the purpose of paying more wages to these aforesaid employees. Theoretically this ought to make them grateful and obliging, though we admit the effect on human nature is apt to be otherwise. However, we hope that Mr. McAdoo's order No. 40 will be beneficial.

The Russian Empire

THE increasing interest in the immediate future of Russia and the keen realization of the critical importance of any move that is made by the Czecho-Slovaks, and by the Entente in coöperation with them, are apparent to all who are making a study of Russia in her relation to the war. In view of the general interest in the Russian question we republish a map of Siberia on page 342 in this issue.

BY THE WAY

Peter O'Riley, one of the discoverers of the Comstock Lode, held his interest in the Ophir mine longer than any of the original locators, and realized nearly $50,000. A little later he and his assistants speculated, until one day poor old Pete found himself with pick, shovel, and pan, and going forth to prospect, wrote Dan De Quille in "The Big Bonanza."

Being a spiritualist, and always having the latest advices from the ghosts of the departed in regard to mines and all else worth knowing about, O'Riley did not consider it necessary to wander far. The spirits pointed out a place in the foothills of the Sierra Nevada Mountains, where they said was stored up far more gold and silver than in the whole Comstock Lode.

The place to which O'Riley was "led" was nothing more than a bed of rotten granite. Here he toiled along, running a tunnel, working for two or three years under all manner of difficulties. As he worked alone in the dark, far under the mountain, month after month, the spirits began to grow more and more familiar. They swarmed about him, advising him and directing the work. And as he wielded pick and sledge their voices came to him out of the darkness which walled in the light of his solitary candle, cheering him on.

News at length came that O'Riley had been caved on and was badly hurt. Then that the physicians had pronounced him insane. When he recovered, he was anxious to return to his tunnel—the spirits under the mountain were calling to him—but he was sent to a private asylum for the insane, and in a year or two died there, the spirits lingering about him to the last, and heaping on him reproaches for having left the golden mountains and silver caverns they had pointed out to him.

Personals

Have You Contributed to the Association of the 27th Engineers?

C. P. Bernard has returned to New York from Africa.

M. S. Davys has returned to Nelson, B. C., from a trip to Cooks' Inlet, Alaska.

E. E. Calkins is back at Miami, Ariz., after having examined mining properties in New Mexico.

M. R. Hull has accepted an appointment with the Nevada Consolidated Copper Co., McGill, Nevada.

Kirby Thomas is in Quebec, making an examination of asbestos properties in the East Broughton district.

Charles A. Randall is now assistant manager for the Dome Lake Mining and Milling Co., Ontario, Canada.

C. M. Clark is making an examination of the Lulea mine, near Hay Lake, in the Rice Lake district of Manitoba.

Howland Bancroft has returned to Denver, after having spent seven weeks in Washington on war work.

Richard G. Place has been appointed chief chemist at the Vermont Copper Co.'s plant at South Strafford, Vermont.

Robert Dye has been appointed manager for the Teck-Hughes Gold Mine Co., Ltd., Kirkland Lake, Ontario, Canada.

Ralph Weston has resigned from the position of metal mine inspector, State of Utah, and has gone to California.

J. B. Landfield, formerly mining engineer in an advisory capacity to the Russian government, is now in Washington.

H. P. Nagel has been appointed mine superintendent for the Sunnyside Mining and Milling Co., Eureka, California.

L. D. Cooper, chief engineer for the E. T. Longyear Co., of Minneapolis, was in New York last week en route to Vermont.

J. Cleveland Haas, of Spokane, Wash., has been visiting mining properties in the Boundary district of British Columbia.

T. J. Harwood, late manager of the Schumacher gold mine, in the Porcupine district of Ontario, has gone to Los Angeles, California.

A. R. Globe has resigned from the position of assistant manager for the Hollinger Consolidated Gold Mines, Ltd., Ontario, Canada.

Albert Burch is now associated with the Bureau of Mines, and will be concerned with the encouragement of chrome-ore production.

C. E. Drayer has been elected secretary of the American Association of Engineers, with headquarters at 29 South La Salle St., Chicago.

A. T. Thompson, assistant to the president of the Phelps Dodge Corporation, is at Los Angeles, recovering from an operation for appendicitis.

N. A. Stockett, previously with the St. Joseph Lead Co., has been commissioned to a second lieutenancy in the engineers' corps, U. S. A.

Seldon S. Rogers is in charge of the crushing and flotation departments at the Anaconda Copper Mining Co.'s plant at Anaconda, Montana.

M. W. Bacon, of Spokane, Wash., formerly manager of the Stewart Mining Co., operating near Kellogg, Idaho, was at Phoenix, Ariz., on August 12.

Norman Dye, of Rochester, N. Y., has been made manager of Clevinger Prophet Silver Mines, Ltd., on the Mann ridge, Gowganda district, Ontario.

C. P. Tomlinson, of Hartford, Conn., has been appointed consulting engineer for the Southern Minerals Corporation, of Boston, of which he is also a director.

E. H. Wells, of the New Mexico State School of Mines, at Socorro, is investigating manganese deposits in Grant County on behalf of the U. S. Geological Survey.

Albert L. Waters left Phoenix, Ariz., on Aug. 11 for San Francisco, en route to Hongkong, China, where he will take charge of a smelting enterprise for American capitalists.

George B. Louderbach, professor of geology at the University of California, is to be in charge of the Bureau of Mines' campaign for increased manganese production in the Pacific Coast states.

John D. Ryan, director-general of aircraft construction and president of the Anaconda Copper Mining Co., has returned to Washington after a visit to the spruce camps in the West.

C. M. Eye, superintendent for the Berguet Consolidated Mining Co., who has been spending a summer vacation in North China, will be back in Baguio, P. I., on August 1.

H. O. Robinson has returned to New York from Venezuela, where he had been for several months in charge of the development and equipment of a magnesite property on the island of Margarita.

M. M. Summerhayes, formerly manager of the Porcupine Crown Gold Mining Co.'s property at Timmins, Ontario, Canada, has been appointed manager for the Bluestone Mining and Smelting Co. of Nevada.

W. A. Carlyle is now general manager and vice-president of the British American Nickel Corporation, Ltd., Sudbury, Ontario, Canada, having taken over the duties previously assigned to E. P. Mathewson.

D. B. Dowling, of the Canadian Geological Survey, has been commissioned to supervise the work of testing the gases of the Alberta gas fields to ascertain their gasoline content. He will begin in the Calgary field.

A. H. Burroughs, Jr., formerly engineer for the Conrey Placer Mining Co., Ruby, Mont., has gone to Washington and entered the Bureau of Ordnance, Navy Department, as a technicist, with the rank of ensign.

O. B. Smith, superintendent of the mines of the Granby Consolidated Mining, Smelting and Power Co., of British Columbia, has returned to the mines from Vancouver, where he recently underwent an operation.

B. H. Dunshee, until recently assistant general manager of the mining department of the Anaconda Copper Mining Co., when he resigned on account of ill health, has gone to California, where he will make his home.

G. H. Cox, of the firm of Cox & Radcliffe, consulting engineers of Tulsa, Okla., and head of the department of geology of the Missouri School of Mines and Metallurgy, has been appointed assistant director of that school.

W. G. Swart has been elected the first president of the newly organized Duluth Engineers' Club, whose members will include representatives of the mining, mechanical, electrical and civil engineering professions.

C. S. Blair, geologist for the Tennessee Coal, Iron and Railroad Co., is making a tour of the Southwest inspecting possible sources of manganese supply. His headquarters will be at Tucson, Ariz., until this work is completed.

Joseph Inch has resigned from the position of chief engineer with the Cia. de Minas de Cobre de Gatico and has been appointed manager for the Soc. de las Minas de Cobre de San Bartolo, San Pedro de Atacama, Antofagasta, Chile.

A. A. Hassan left on Aug. 24 for New Brunswick, Canada, to examine manganese and pyrrhotite deposits. He will then proceed to Halifax, N. S., to examine the Montague gold deposits and to Tangier, N. S., to examine the Bradford gold mine.

E. Tsutsjima, Buhei Sakane and **Fashimatsu Kawamoto,** three Japanese business men appointed by their government as a commission to purchase nickel and zinc in America for war requirements, have arrived in Toronto on their way to visit the nickel and zinc fields of Canada.

Eugene Poitevin, of the staff of the Canada Department of Mines, Ottawa, has been investigating conditions in relation to the occurrence of platinum at Olivine Mountain, Tulameen district, B. C., in company with **P. B. Freeland,** district engineer for the Provincial Department of Mines.

A. P. Rouillard, of the Durban-Roodeport Deep, Transvaal, South Africa, has resigned to enter war service. The direction of the property passes under the contol of **Charles Glyn,** manager of the City and Suburban Gold Mining Co., who is succeeded by **H. C. Hilton** of the Village Main Reef.

Addison H. MacKay, formerly in charge of the Harriman oil interests in the Tampico district, has returned to the United States, after several months in Venezuela, where he obtained important concessions, covering oil, copper and chrome. His address is the New York Club, New York.

R. N. Kotzé, Government Mining Engineer of the Transvaal since 1908, has been made a Knight Bachelor. Mr. Kotzé was educated at Capetown and took his diplomas in mining and metallurgy at the Royal School of Mines, Clausthal, Germany. In 1896 he was appointed assistant engineer, and later consulting engineer, to the Transvaal Goldfields, and relinquished that position for his present one in 1907.

O. M. Bilharz, of Pittsburg, Kan., has lately acquired interests in the Batesville manganese field, in Arkansas. Among others who are reported to have become interested in properties in this field are **C. H. Plumb,** of Joplin, Mo., and **Otto Ruhl,** also of Joplin, the latter of whom is spending considerable time in the district supervising operations. **L. F. Hirschler,** formerly in charge of the Edith zinc mine at Rush, Ark., **J. Reed,** a mining engineer of Memphis, Tenn., and **P. R. Coldren,** editor of the mining department of the "Joplin Globe" have been recent visitors in the Batesville district.

Obituary

A Memorial Service, in appreciation of the personality and life work of the late Dr. James Douglas, will be held during the Colorado meeting of the American Institute of Mining Engineers at 12 noon on Tuesday, Sept. 3, at a place to be announced later.

George E. Price, formerly manager of the Rudeshill mine, died at Charlotte, N. C., on July 24. Mr. Price had carried out professional work in many parts of the world, including Western Australia, West Africa, Canada, and Bolivia, as well as gaining a wide experience in the United States. He was born at Dayton, Ohio, on Jan. 1, 1858.

J. V. Kelly died at San Antonio, Tex., on Aug. 3. He was a graduate of Harvard University and had been actively engaged in mining engineering work for the last 12 years in the United States, Cuba, Mexico and Central America. Mr. Kelly recently resigned his position as general mine superintendent of the La Blanca y Anexas Mining Co., of Pachuca, Mexico, to report for duty with the Engineers Reserve Corps, in which he had been commissioned a captain.

Prof. Auguste J. G. Ledoux, of the Ontario Bureau of Mines, died suddenly at Sudbury, Ont., recently. He was professor of mineralogy and geology at Brussels University at the outbreak of the war, and enlisted in the Belgian artillery, in which service he was severely wounded. On his discharge from the army three years ago, Professor Ledoux came to Canada, and last year was appointed by the Ontario Bureau of Mines to investigate the sand and gravel deposits of the province. He leaves a widow.

William Haymond Powers, pioneer of Inyo County, Calif., died at Bishop on July 23. He was born in Henry County, Indiana, in 1848, and, with his parents, crossed the plains to Nevada in 1863, traveling by ox team. The family settled in Carson Valley, but later, in 1866, William and his elder brother Jacob went to Bishop, Calif. William Powers and Miss Alinza Burdick, whom he married in 1870, made, with others, the first American flag seen in Inyo County, from red and blue woolen blankets and white flour sacks.

Adolph Faber du Faur died at Newark, N. J., on the 18th inst., in his 92d. year. He was born in Württemberg, Germany, an ancestor being one of those who escaped from Paris at the time of the massacre on St. Bartholomew's night, his mother being a direct descendant of Martin Luther. He came to America in 1850, served in the Civil War and was commissioned a captain, afterward being engaged in engineering work in connection with the extension of the Capitol at Washington. Although an inventor and engineer of wide and varied ability, Captain Faber du Faur's name is primarily associated with the furnace he invented, which has survived as a detail of standard equipment in the metallurgy of lead and, in a slightly modified form, has been used extensively for the smelting of gold and silver precipitates from the cyanide process. This apparatus was the first type of tilting furnace used, where the crucible remained in the furnace during the pouring of the bullion.

Societies

The Engineers' Club of Northern Minnesota will make a trip through the Cuyuna range on August 24.

The National Safety Council will hold its annual meeting and congress from Sept. 16 to 20, inclusive, at the Statler Hotel, St. Louis, Mo. A small safety educational exhibit will be shown in the hotel, earlier plans of arranging for elaborate displays at the Coliseum having been abandoned.

The Lehigh University three-year course in ship construction and marine transportation, to be started in September, will be under the direction of Professor F. P. McKibben, head of the department of civil engineering. The new course will be a combination of engineering and economics to prepare students for ship construction during the war and, in addition, foreign commerce afterward. Lehigh now has a full quota of student representatives at the Government camp at Plattsburg, N. Y., where they are receiving training that will equip them to assist army officers at the university next year in the War Department instruction in military drill and science.

The American Ceramic Society announces the inauguration of a monthly journal to take the place of the annual volume of transactions previously published. The society belongs to the older family of scientific societies in the United States. The first meeting, which was in reality a gathering of a small group of ceramic enthusiasts, was held in Columbus, Ohio, in February, 1899, and from that meeting grew the present organization. The term "ceramic" is synonymous with "silicate industries," and the interests and activities of the society include all branches of the clayware, glass, and cement industries, as well as enameled wares of all kinds, and, in addition, other closely allied products are included, chief among which are abrasives, gypsum and lime. Few realize the gigantic proportions of these industries. The products of the three major divisions alone (clayware, glass, and cement) aggregate a value of over $400,000,000 per annum. In the earlier days the society consisted of one main organization only. With increased activities and with enlargement in its scope of usefulness it became necessary to organize 10 local sections and 4 student branches. The publication work of the society has, up to the present time, been confined to the issuing of the annual volume of transactions. The growth of the society has made it essential that periodical publication of the researches and other activities of the members be undertaken; and the monthly "Journal of the American Ceramic Society" is the logical result. The contents of the first number include the following original papers and discussions: "Kaolin in Quebec," Keele: "Special Pots for the Melting of Optical Glass," Bleininger; "The Effect of Gravitation Upon the Drying of Ceramic Ware," Washburn; "Test of a Producer Gas-Fired Periodic Kiln," Harrop; "Notes on the Hydration of Anhydrite and Dead-Burned Gypsum," Gill. The present officers of the Society are: President, Homer F. Staley; vice president, A. F. Greaves-Walker; treasurer, R. K. Hursh; secretary, Charles F. Binns; trustees, A. F. Hottinger, E. T. Montgomery, and R. D. Landrum.

Institute of Metals division of the American Institute of Mining Engineers, with the iron and steel members of the latter and the American Foundrymen's Association, will hold a meeting at Milwaukee, Wis., to open on Oct. 8. The papers to be presented by the Institute of Metals division are given below: those under the auspices of the committee on iron and steel, Joseph W. Richards, chairman, will deal with iron ores, iron and steel metallurgy, and related subjects. Programs for the meetings, as provisionally arranged, are as follows: Tuesday morning, Oct. 8: "The Metallography of Tungsten," by Zay Jeffries. (See A.I.M.E. Bull. No. 138, p. 1037.) "The Constitution of the Tin Bronzes," by S. L. Hoyt. A paper will also be read by C. H. Mathewson. Wednesday morning, Oct. 9: Symposium on the conservation of tin. Among those taking part will be G. W. Thompson, of the National Lead Co.; G. H. Clamer, of the Ajax Metal Co.; C. M. Waring, of the Pennsylvania Railroad Co.; M. L. Lissberger, of Mark Lissberger & Son, Inc.; D. M. Buck, of the American Sheet and Tin Plate Co.; W. M. Sorse, and M. L. Dizer, of War Industries Board. Wednesday afternoon, Oct. 9: "The Volatility of the Constituents of Brass," by John Johnston. (See "Journal," Am. Inst. Metals, March, 1918, p. 15.) "Notes on the Metallography of Aluminum," by P. D. Merica and J. R. Freeman, Jr. "The Effect of Impurities on the Hardness of Cast Zinc or Spelter," by G. C. Stone. (See "Journal," Am. Inst. Metals, March, 1918, p. 11.) "Dental Alloys," by Dr. Arthur W. Gray. Thursday morning, Oct. 10: "Notes on Non-metallic Inclusions in Bronzes and Brasses," by G. F. Comstock. (See "Journal," Am. Inst. Metals, March, 1918, p. 5.) "Nichrome Castings," by Arlington Benzol, of the Driver-Harris Wire Co. "Fusible Plug Manufacture," by G. K. Burgess and L. J. Gurevich. "Application of the Spectroscope to the Chemical Determination of Lead in Copper," by Messrs. Hill and Lucke. Also a paper, by P. D. McKinney. The sessions on iron and steel will be held during the morning and afternoon of Wednesday, Oct. 9. In addition to a number of papers on iron ore, ferroalloys and other allied subjects, interesting lectures, to be illustrated by moving pictures, will probably be given, on the manufacture of steel, and on the training and employment of cripples in industry.

Industrial News

E. J. Albert has resigned from the management of the mining and power department of the Canadian Allis-Chalmers, Ltd., and has been appointed sales manager for the Thwing Instrument Co., Philadelphia.

The Truck Owners' Conference, Inc., will hold 19 two-day conferences, in as many cities, during the next ten months. The purpose throughout is to secure greater efficiency in truck operation. The opening conference will be held in Detroit, Sept. 19 and 20, at the Board of Commerce building.

The Hardinge Conical Mill Co. has published under the title "What Really Happened—The True Story of a 'Test' (?)," a reprint of E. H. Kennard's contribution to the discussion of C. T. Van Winkle's paper on ball-mill performance which was published in the April, 1918, bulletin of the American Institute of Mining Engineers.

Traylor Engineering and Manufacturing Co., manufacturers of mining, milling and smelting equipment, of Allentown, Penn., announce the opening of a district office at 612 and 614 Mohawk Block, Spokane, Wash., in charge of **W. H. Agens,** district manager, and another at 900 Citizens' Bank Building, Los Angeles, Calif., in charge of **Harry V. Croll.**

E. P. Dillon, manager of the power division of the New York office of the Westinghouse Electric and Manufacturing Co., has resigned to become general manager of the Research Corporation, of New York. Mr. Dillon came to the Westinghouse company in 1909, having been previously connected with various mining and electrical companies in Colorado.

The Radium Ore Sampling Co. announces the completion of a rare-ore custom sampler at Montrose, Colo., where all kinds of rare and precious ores and concentrates may be sampled. Particular attention has been given to the matter of making accurate moisture determinations, and to the collecting, saving, and sampling of the valuable dust of carnotite and other rare oxide ores. Ore can be ground as fine as 20 mesh and all the product carefully screened if desired. Adequate precaution is furnished in the nature of protection from theft and fire. Prices will be furnished upon request, covering kind and quantity of material involved and size of fineness desired. Thirty days' free storage is allowed on all shipments from time of arrival, and, when desired, orders from producers or shippers will be accepted for any or all stages of transportation charges to the sampler, subject, of course, to the value of the ore covering such accounts after payment of charges.

Trade Catalogs

The Blaster's Handbook, a pocket textbook, has been issued by E. I. du Pont de Nemours & Co., of Wilmington, Del., which tells, in detail, how to blow soot from big chimneys, how to break up old boilers and heavy machinery, and how to use explosives for every purpose where their employment is practicable. It gives information regarding the proper explosive to use, the quantity, the method of loading and firing. The book is illustrated and contains charts and diagrams that make it a valuable addition to any technical library.

Westinghouse Instruments and Relays is the title of catalog 3-B, of which a revised edition has just been issued. Among apparatus listed for the first time are type AW and type FW duplex instruments, type EH and PH ammeters, which are hot-wire instruments suitable for operation on either d.c. or a.c. circuits of any frequency; type OA watt hour meters for switchboard service, which are similar to the well-known standard house-service type OA watt hour meters, except that they are designed for switchboard service; the motor-operated type M graphic instruments; type CV voltage relays, which can be furnished to operate either on under-voltage or over-voltage, as ordered; the type CP reverse-phase relays to provide against phase reversals; type BT transfer relays, which operate with the excess current relays, such as the Westinghouse type CO and type CR, to directly energize the operating coil of the circuit-breaker from the current transformer, no separate operating circuit being required; and type CT temperature relays, which depend for their operation upon the temperature of the apparatus on the circuit as well as the amount of the overload. 8½ x 11 in.; pp. 101, illustrated.

"Potentiometer System of Pyrometry and Temperature Control." Leeds and Northrup Co., Philadelphia, describes a system of pyrometry and temperature control in which the potentiometer method is employed for measuring the electromotive force of thermocouples. A known electromotive force is included in the circuit with the thermocouple and, by varying this, the current can be also varied until a galvanometer, in the circuit, indicates that no current is flowing. When this has been done the thermocouple electromotive force is, of course, equal to the known electromotive force. Due to the fact that no current flows at the moment of measurement, changes in the resistances of lead wires, thermocouples, galvanometers, etc., are eliminated and do not affect the result. By making the lead wires of the same material as the thermocouple, the "cold junction" of the latter is brought back to the instrument, where its effects can be compensated automatically. The variable electromotive force is obtained by a moving contact along a slide wire through which a standardized current is flowing. This may be done by hand, as in potentiometer indicators, or by mechanical power as in the Leeds & Northrup Recording Potentiometers. In these instruments the galvanometer acts merely as a trigger or pilot. When deflected, the boom is forced by reciprocating parts against other parts which mechanically adjust the slide wire contact, the amount of adjustment depending upon the amount of deflection. When no current is flowing the boom stands at the neutral position and there is no adjustment. It is thus possible for a delicate and sensitive galvanometer to control the expenditure of a considerable amount of power. This fact has been taken advantage of to construct curve-drawing and multiple-circuit printing recorders, and also to operate signal lamps and indicators at the furnaces. The recorder thus takes the place of an attendant, who would otherwise be required to read the pyrometer and to signal its indications. The potentiometer is also applied to a special apparatus for the location of the thermal transformation or recalescence and decalescence points of metals. The Leeds & Northrup Co. has developed an apparatus by which temperatures are plotted as ordinates, and temperature differences between the sample and a non-recalescing body on a magnified scale as abscissæ. This shows the transformation points graphically, as the temperature of the sample remains nearly constant for a time at such points, although the non-recalescing body continues to change. Pp. 60; 8 x 10½ in.; illustrated.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Ore Separator—Robert E. Nelson, Keystone, S. D. (U. S. No. 1,272,301; July 9, 1918.)

Nitrogen, Production from the Air.—Carlo Andreucci, Rome, Italy. (U. S. No. 1,272,181; July 9, 1918.)

Air-Washer—Donald T. Hastings, Detroit, Mich., assignor to Holly Bros. Co., Detroit, Mich., (U. S. No. 1,272,434; July 16, 1918)

Belt-Tightener—Antone J. Adamek, Orient, S. D. (U. S. No. 1,272,350; July 16, 1918)

Cable Grip—Thomas J. Craven and Daniel J. Crilly, Detroit, Mich. (U. S. No. 1,272,392; July 16, 1918)

Centrifugal Pump—James D. Bell, Seattle, Wash. (U. S. No. 1,272,606; July 9, 1918)

Converter Lining—Frank E. Hinners, Milwaukee, Wis. (U. S. No. 1,272,442; July 16, 1918)

Drier—Charles H. Klein, Chaska, Minn. (U. S. No. 1,272,676; July 16, 1918)

Drier—Frederick K. Fish, Jr., New York, N. Y., assignor to Lumber Tie and Timber Vulcanizing Co., New York. (U. S. No. 1,272,649; July 9, 1918)

Editorial Correspondence

WARREN, ARIZ.—Aug. 12

Announcement of a New Housing Plan has been made by the Phelps Dodge Corporation and the Calumet & Arizona Mining Co. The plan provides that the companies will build homes and sell them to the employees on terms of rent, with interest on deferred payments at only 6%. The new proposal will give a considerable relief to the congested housing conditions of the Bisbee district. Over 80 applications have already been made by employees of the Copper Queen, and the plan is certain to bring relief to the district.

JEROME, ARIZ.—Aug. 12

The Building Program of United Verde Copper Co. consists of the following: Emergency hospital at Clarkdale; apartment building at Jerome of 33 three-and four-room apartments; eight patio groups of six three-room houses at Clarkdale; 20 five-room houses at Clarkdale; completion of old hospital building at Jerome to provide housing for single men; 20 four-room houses at Jerome, four 16-room concrete bunkhouses at the steam-shovel camp, and a clubhouse at Clarkdale.

BUTTE, MONT.—Aug. 13

No Movement Toward a Strike has been made here, although the matter of calling one was left in the hands of the executive committee of the Metal Mine Workers' union, affiliated with the I. W. W. City and county authorities were called recently into a conference with the officer in command of the Federal troops here. The chief of police and the sheriff were directed to place under arrest every man who is not working and who refuses to go to work. It is estimated that there are in Butte at least 1000 idlers and men not engaged in useful occupation. They are being arrested, and those who promise to go to work are given a card and allowed 24 hours in which to get into the hay fields or the mines. Consequently, every I. W. W. man who is here will either walk out of the city or go to work.

JOPLIN, MO.—Aug. 14

A Site for an Ore Warehouse at Picher, Okla., to be used in conjunction with the operation of an Oklahoma Mining Exchange, has been secured, and it is stated that a building will be erected at once. Many operators and mine owners in the field have given their support to the plan for the mining exchange and warehouse, which was proposed a few weeks ago at Miami, but other operators and mine owners are holding aloof and prefer to wait before going into the proposition. Other such schemes in this field have fallen through, and older operators are doubtful in this case. They admit, however, it would likely be a good thing if it could be properly worked out and if all mining men in the district would give their assistance.

No New Machinery for Mill Building in this district is the slogan of one of the largest machinery concerns in Joplin, and the idea is expected to be endorsed by all machinery dealers in the district. Rumors of the plan led to other rumors to the effect that the Government had issued orders that no more new mills be built in this field. The latter rumor is not correct, but the machinery house in question has decided that it would be unpatriotic to ask for new steel to use in mill building when there is an abundance of second-hand machinery in the field. This company does not deal in second-hand machinery, so its decision is free from question on the score that it is trying to better its own interests. It will undoubtedly lose considerable business by its rule. The supply of second-hand machinery in this field, which was decidedly short two years ago, has suddenly become plentiful. At this time there is little opportunity for the sale of new mining machinery unless it is of some new pattern or design that has not been used here generally. Numerous mills that were "promotion" schemes only are now on the market.

Organization of a Local Branch of the American Zinc Institute was decided upon by about 50 mine owners and operators who met in Joplin on Aug. 10. Victor Rakowsky, who was instrumental in the formation of the National American Zinc Institute, called the local meeting and presided as chairman. It was decided by the operators present, who represented more than 80% of the zinc production from this field, that it would be well to form an organization to include representatives from the mercantile and banking interests of the district, as well as from the mining industry. A committee of three, P. B. Butler and F. C. Wallower, of Joplin, and R. D. Tuthill, of Miami, all representing mining interests, was named by Mr. Rakowsky and empowered to select four more men from the mining industry, the seven to form the first board of directors for the new organization for the coming year. One of the duties of this committee, besides the completion of the organization plans, will be the selection of a committee of 51 members, 17 of whom are to come from the mining, 17 from the mercantile and 17 from the banking interests of the district. This committee will be entrusted with the task of raising at once a fund of $50,000, to be used in defraying the expenses accrued and accruing for the betterment of the industry during 1918 and thereafter. It will be known as the Missouri-Kansas-Oklahoma War Chest Fund. It is not certain that the new body, which is to be known as the Missouri-Kansas-Oklahoma Zinc Institute, can become a part of the American Zinc Institute, recently formed at St. Louis, under the plan of organization as outlined at the meeting here, but at least application for entrance will be made. A resolution adopted provided that the plan of organization should be drawn up along lines to conform with those of the American Zinc Institute.

MOUNTAIN HOME, ARK.—Aug. 13

Development in the Batesville Manganese Field is progressing rapidly. Activity is marked in the transfers of land and leases, and the influx of new operators is heavy. Owing to the fact that the ore occurs in clay, and in most instances is determined by outcrops, little development work is necessary before production can be made, and production is picking up rapidly, many properties having been brought to a producing stage since activity started early in the year. Shaft and drift methods of mining are being used in some instances, when the orebody is penetrated from the top, and the overlying Boone chert is too thick to strip, but most of the work is by open-pit methods. Prospecting is general over the entire field, and is broadening the ore-producing area. A number of washing plants are in operation, several are under construction and will be completed within the next sixty days, and many more are planned or contemplated. If present conditions hold, there will be at least 25 in operation by the first of 1919, with capacities of from 100 to 300 tons per day. Hand jigs are also being pressed into service and are in use all over the field. They are of the same type used in cleaning and concentrating zinc ores. Regular Joplin-type jigs are a part of the equipment in most of the new plants under construction. They will be used in the final cleaning and concentrating process, the finer product going into them after passing through the log washer which does the preliminary work. A few of the plants that are in operation and some under construction are straight jig plants, the log washer not being used at all. Instead of trams to carry the crude ore from the pits or mines to the washer, some of the operators are installing flumes, which are feasible, owing to the fact that all the ore occurs in clay. A pipe line follows the flume, the crude ore is dumped directly into it and carried by water and gravity to the plant. This process removes a large part of the clay before the crude gets to the plant. Cushman, the hub of the manganese industry, in this section, for years has been a sleepy little mountain village, but is now taking on all the general characteristics of a live Western camp. The heaviest flow of new operators is coming from southwest Missouri and the North Arkansas zinc fields. Most of the operators are experienced mining men. This is giving the field a stability that promises its maximum development. The price set on ore in May is also having the effect of stimulating development.

GOLD HILL, ORE.—Aug. 15

Recent Uncovering of Large Chrome Deposits on the extensive serpentine dike extending through the north end of Jackson County may make the Gold Hill district a chrome producer which will equal the output of the Waldo district, in Josephine County. The new find adjoins the famous hydraulic placer mines on Pleasant Creek. The ore runs 45%, will be mined by open cuts, and is situated on a good county road 14 miles to the shipping point at Rogue River, nine miles west of Gold Hill.

Interest in Gold Mining has increased in the Gold Hill district since gold mining has been listed as an essential industry by the War Industries Board. In 1914, the Ashland, Braden, Bill Nye, Opp, Lucky Bart, and many other well-equipped gold mines in the district suspended, and operators took up the mining of quicksilver, manganese, chrome and other war metals. In view of the rich strikes in the 400 and 600 levels of the Ray & Haff mine three miles north of Gold Hill, the reopening of the Red Oak group, and negotiation for the reopening of the Braden and several other old producers in spite of the rising expense of mining, a general revival appears assured.

SPOKANE, WASH.—Aug. 16

The Northwest Mining Association is making plans for the gold convention to be held in Spokane, on Sept. 5, and is having a splendid response from several districts, indicating a large attendance. R. F. Green, member of Parliament from West Kootenai, B. C., will attend, and it is also expected that J. F. Gallbreath, secretary of the American Mining Congress, will be present. Invitations have been sent to all districts of Washington, Oregon, Idaho and Montana. The producers of each district will be asked to form local bodies and crystallize sentiment on the means for alleviating the hardships of operators at the standard price for the metal. They will be asked to send a delegate with the sentiment of the local in concrete form, that the organization may act promptly and simultaneously with other sectional organizations throughout the West.

TORONTO—Aug. 17

The Price of Platinum in Canada, according to an arrangement affected by Hon. Martin Burrell, Canadian Minister of Mines, with the Imperial government, has been fixed at $105 per oz., in uniformity with the price in the United States.

Prospectors and Owners of Mining Claims in Northern Ontario find increasing difficulty in securing men to do assessment work, the great demand for labor for harvesting having reduced the number of men available. Unless the stringency of the regulations regarding assessment work is relaxed, many are likely to lose their claims through being unable to complete the work within the time limit. It is expected that in cases where an effort has been made to comply with the law, the government will not insist on its rigid enforcement.

Boundaries of the Temiskaming Mining Division of Northern Ontario have been arranged so as to include the Doherty silver area, with recording office in Haileybury. The division now embraces the townships of Strathy, Strathcona, Law, Olive, Milne, Askin, Riddell, Cassel and that part of the Temagami forest reserve lying east of the Temiskaming & Northern Ontario Ry. The rearrangement is welcomed by mining men and prospectors interested in the Doherty district, who have been put to some inconvenience owing to the records for that section being kept in Toronto.

Sheelite Deposits Near Falcon Lake, Manitoba, are to be thoroughly tested. A force has been sent from Winnipeg, in charge of E. E. Kain, to operate the Empress claims, in the Star Lake area, and take out a car of ore, which will be shipped to Ottawa. Arrangements have been made

with the Imperial Munitions Board to have the first shipment treated gratis, and should the product prove of commercial value the Munitions Board will fix a price for the treatment of further consignments that will just cover the cost. A small concentrating mill will then be built and a steamer put on the Falcon River.

RIO DE JANEIRO—June 12

Ouro Preto Gold-Mining Co. in its report for 1917 states that during the year 82,500 tons of ore was mined, which produced 28,840 oz. gold. The working cost per ton over that of 1916 was 41 farthings, the total profit having been £4832, as compared with £7240 for the preceding year. The superintendent of the mine reports the discovery of good deposits of manganese at shallow depths on the Morro de Sant' Anna property belonging to the company, and that the exploitation of this mineral here, as well as at other places in Minas Geraes, offers good profits were it not for the heavy export taxes and the prohibitive freights on the railway.

CAIRNS, QUEENSLAND—July 6

Copper, Tin and Rare Metal Production of Queensland may suffer unless the I. W. W. element is stamped out. The labor government of the state is not active in this direction. However, a measure has been proposed which intends purchasing the Chillagoe mines, smelteries and railways and placing their operation under the state government. The mines and plants have been closed since 1914.

The Kitchener Molybdenite Mine, situated 120 miles west of here, has a good showing on several levels where the mineral occurs in a white quartz fissure vein. Treatment consists of stamping and flotation, which secure a high and clean recovery. Present reserves are estimated as being valued at $1,000,000, and the property will doubtless become an important producer. Present capacity of stamps is a ton of metal per week. Another concern operating in North Queensland is the Thermo Electric Ore Reduction Corporation, Ltd. This company has mines situated at Wolfram and Mount Carbine, both 80 miles west of Cairns. Bismuth, tungsten and molybdenite are mined. However, owing to a strike, the mines and stamp mill are not now being worked. Dissatisfaction is expressed over the present prices paid for Australian molybdenite and tungsten by the Imperial government. In the case of molybdenite, £5 per unit is paid and for tungsten or scheelite, 52s. per unit. By selling to United States markets, Canada can realize nearly double this price.

The Mining News

ARIZONA

Cochise County

SHATTUCK, ARIZONA (Bisbee)—July production was: Copper, 672,024 lb.; silver, 12,292 oz., and gold, 103 oz. Production for seven months of 1918 was: Copper, 5,878,198 lb.; lead, 444,937 lb., silver, 86,271 oz., and gold, 706.60 ounces.

Greenlee County

CORONADO (Clifton)—Accumulated gas from fire caused explosion, and subsequent cave-in resulted in the death of a shift boss and two miners.

Mohave County

CAMP BIRD (Kingman)—Shaft down 118 ft. Crosscutting vein on 100 level.

GOLDEN CROSS (Kingman)—Resumed work on Jack Pot claim. To sink vertical shaft to cut the vein at 150 level.

RICO EXPLORATION (Kingman)—Sinking below permanent water level. To crosscut vein at 200 level and drift through orebody.

RURAL (Kingman)—To be equipped with hoist and other machinery. Shaft is being unwatered.

Pima County

CHAMPARADO (Tucson)—Hoist to be installed.

Pinal County

ARIZONA HERCULES (Ray)—Has moved the dismissal of several suits, involving spur tracks, ore bins, mill and electrical service, against Ray Consolidated Company.

Santa Cruz County

FLUX (Patagonia)—Operating 200-ton mill and handling sand-carbonate carrying lead and silver.

Yavapai County

BIG LEDGE (Huron)—Sump on 450 level of Henrietta mine completed.

GRAND ISLAND (Jerome)—Completed enlargement of 208-ft. shaft to three-compartment and will sink soon.

GREEN MONSTER (Jerome) — Shaft down 795 ft. and in diorite.

JEROME VERDE (Jerome)—Raise to connect Maintop orebody with 1100 level to be completed soon.

UNITED VERDE EXTENSION — (Jerome)—Have ceased shipping ore to custom smelteries, and entire mine product is being sent to smeltery at Verde.

VERDE COMBINATION (Jerome)—Installation of pipe connecting pump on 1080 level to outlet in Mescal tunnel has retarded development work.

YABA COPPER (Jerome)—To operate group of claims near the United Verde.

ARKANSAS

Independence County

DENNISON-BARKSDALE (Batesville)—Have purchased 160 acres of manganese land on Lafferty Creek, and will install the first hydraulic washer in the manganese field. Equipment will consist of 1200-gal. pump, 2500 ft. 10-in pipe, 100-hp. engine at river, 150-hp. engine at foot of hill for pressure and a 700-gal. 1¼-in. stationary ball and socket nozzle. Final process of cleaning will be done with regular Joplin type jigs.

RUHL (Batesville)—Sixty-acre tract under operation by Otto Ruhl, of Joplin. Development under way.

PAGE (Cushman)—Under operation by Stanley Hanford and Walter Denison. Five shafts in high-grade manganese ore.

CALIFORNIA

Butte County

CHROME DEPOSITS discovered by J. A. Clark near Intake, on the Western Pacific, are being operated under lease.

EMMA (Nimshew)—Operated by Aubrey H. Rugh under lease.

Calaveras County

UTICA (Angels Camp)—New ore recently cut in Cross shaft said to be of sufficient amount to warrant resumption of Stickles mill.

Glenn County

CERESE GOLD (Willows)—Have discontinued operations.

Humbolt County

CHROME MINES at Pecwan Creek and Red Mountain operated by Englebright and Marsh are producing steadily and shipping from Requa by water to Eureka for reshipment by Northwestern Pacific Railway.

Nevada County

UNION HILL (Grass Valley)—Shaft at 1250 level, new station completed at 1200 and pumps and compressors installed. Active development in progress. Tungsten is associated with gold ores and is concentrated on the ground. Concentrates are treated for gold extraction at the Pioneer Reduction works in Grass Valley. Report that the Union was to be abandoned is false. Union is controlled by the Gold Point Consolidated Mines Co., which also controls the Gold Point, South Idaho and Idaho Development Co. mines. Erroll MacBoyle is manager.

San Luis Obispo County

GOODWILL COPPER (San Luis Obispo)—New 200-ft. shaft has cut good ore. Will be developed by 500-ft. tunnel.

Shasta County

SHASTA COUNTY MINERAL PRODUCTION in 1917 amounted to $9,218,396, chiefly copper.

AFTERTHOUGHT (Ingot)—Part of the flotation plant being dismantled and the milling plant to be remodeled.

Siskiyou County

SISKIYOU SYNDICATE (Callahan)—Have ceased to operate gold mines in the Sawyer Bar district and are developing and shipping chrome ore near Callahan.

CHALCO COPPER (Hornbrook)—Have taken over Houstan mine, and Chalco group near Hornbrook. Double-compartment shaft to be sunk 200 ft., with drifts and crosscuts on the Chalco. Also purposes to erect 50-ton mill.

Trinity County

NEELY (Castella)—Three motor trucks used to haul chrome ore to Castella, for shipment by Southern Pacific.

GLOBE (Dedrick)—Recently reported permanently closed down, and plant being dismantled. H. M. Hall, of San Francisco, principal owner, says the mine will not be abandoned, but new development is to begin immediately. Property is equipped with 20-stamp mill, tube mill and cyanide plant and a two-mile aërial tramway.

COLORADO

Boulder County

UTICA (Boulder)—Plans to construct flotation mill when men and supplies are available. C. H. Fry is general manager.

Gilpin County

GILPIN-EUREKA (Central City)—Plans underground development and modernization of mill with flotation unit.

San Miguel County

SHIPMENTS FROM TELLURIDE during July were: Smuggler Union and Black Bear mines, 14 cars to Durango and 51 cars to Pueblo; Tomboy, 25 cars to Durango and 16 to Pueblo; Total, 106 cars, all concentrates. Shipments for same month last year were 127 cars.

CARBONERO (Ophir)—Development in progress in ground operated by the Ruttila-Brown Leasing Co. and payable ore has been opened.

CARRIBEAU (Ophir)—Mine production sufficient to keep mill in operation. Tailings from old dump being treated at flotation plant with satisfactory results. Bunk house, boarding house, and assay office were recently destroyed by fire caused by defective gasoline heating arrangement in assay office.

BLACK BEAR (Telluride)—Shaft sunk to 100 level, station cut and drifting each way on vein.

Teller County

ACACIA (Cripple Creek)—Developing on 1400 and 1700 levels. Kenneth Mackenzie is general manager.

IDAHO

Boundary County

IDAHO-CONTINENTAL (Porthill)—Eleven automobile trucks and 10 wagons used to transport ore from mill to Porthill. Tramway connects mine and mill.

Shoshone County

NABOB CONSOLIDATED (Kellogg)—Cut parallel orebody in raising to Denver tunnel level. William H. Beaudry is manager.

FEDERAL MINING AND SMELTING (Mullan)—Miners at Morning mine and at Gold Hunter property have returned to work.

SARINA (Wallace)—To extend No. 4 tunnel to cut vein disclosed in No. 2 tunnel.

SUCCESS (Wallace)—Have resumed operations after shut-down since last April.

KANSAS

Joplin District

RODERS (Harrison)—Moving and remodeling Jersey 200-ton mill. Will purchase tables, belts, drills, ore cars and track.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Copper production in July was 11,118,426 lb. Producers were: Ahmeek, 1,885,705 lb.; Allouez, 590,449; C. & H., 5,284,105; Centennial 193,006; Isle Royale, 1,279,579; La Salle, 180,706; Osceola, 1,398,216; Superior, 130,600 and White Pine, 215,994 pounds.

HOUGHTON COPPER (Houghton) — Drift on third new vein of Superior lode in good copper rock.

NEVADA

Clark County

MANGANESE ASSOCIATION (Las Vegas)—Low silica manganese ore opened in sedimentary formation 16 miles southeast of town. Ore occurs in flat shoots up to 20 ft. thick. Mining by churn drilling and blasting with black powder. Ore hauled to railroad by truck. Mine owned by Thomas Thorkildsen, of Sterling Bora Company.

Esmeralda County

GRANDMA CONSOLIDATED (Goldfield) —Shaft completed and station being cut at 805 level.

Humboldt County

ROCHESTER MINES (Rochester) — Driving north on 10 and 11 levels in milling grade ore.

Lyon County

MALACHITE COPPER (Mason)—Lessees operating on Malachite and Natchez workings. Shipping good-grade carbonate and sulphide copper ore.

WESTERN NEVADA (Mason)—Making regular shipments of copper sulphide ore. Ore loaded at McConnell spur.

BLUESTONE (Yerrington)—New electric pumping plant completed. New cottages being built for employees.

Mineral County

AURORA CONSOLIDATED (Aurora)—Property closed down, as it cannot be operated at a profit under present conditions. Mill may be dismantled.

WALL STREET (Luning)—Only high-grade copper ore being shipped. Ore packed by burro, wagon haul and then railroad freight.

Nye County

TONOPAH DISTRICT ore production for the week ended Aug. 10 totaled 9183 tons, of an estimated gross milling value of $156,111. Producers were: Tonopah Belmont, 1899 tons; Tonopah Mining, 3250; Tonopah Extension, 2053; Jim Butler, 343; West End, 974; Halifax, 66; Montana, 234; MacNamara, 315; Monarch Pittsburg, 23, and miscellaneous, 26 tons.

BIG PINE (Manhattan)—Milling of over-size mill dump resumed. Work delayed by slow delivery of tube-mill liners. About 200 tons per day being treated.

MANHATTAN CONSOLIDATED (Manhattan)—New vein cut in crosscut on fifth level.

UNION AMALGAMATED (Manhattan) Opening Earl orebody on 700 level.

WHITE CAPS (Manhattan)—Contract let to sink shaft an additional 150 ft. below fifth level.

TONOPAH BELMONT (Tonopah)—New 300-ton mill of Belmont-Wagner Development Co., a subsidiary company at Telluride Colo.; formerly the Alta mine, completed and ready for operation.

TONOPAH DIVIDE (Tonopah)—Crosscut on 370 level recently opened gold-silver vein. Drift extended 50 ft. to southeast in ore; full width of drift in ore and one wall not exposed. To crosscut every 50 ft. to expose full width of oreshoot.

TONOPAH MINING (Tonopah)—Examination of property in Nye County is under way. If taken, will be purchased in name of Nevada Wonder Mining Co., a subsidiary company.

OKLAHOMA

Joplin District

QUEBEC (Douthat)—Mill completed and plant to be started soon. E. R. McClelland, Kansas City, is owner.

BIG TEN (Lincolnville)—Sinking shaft and probably will build mill.

LEAD BOY (Miami)—To remodel and enlarge concentrator to 250 tons. Expect to purchase tables, crusher and compressors. R. H. Elkins is superintendent.

LUCKY JOE (Miami)—Changed from steam to gas power and started mill.

WAXAHACHIA (Miami) — New mill ready for operation, but, there is a scarcity of water. Attempt to be made to get sufficient water from drill hole on property.

ACME (Picher)—Operating after shut-down of several weeks due to broken compressor.

CORTEZ (Picher)—To build 250-ton mill and expect to purchase tables, crushers, compressors, conveyors and gas engine. W. T. Landrum is superintendent.

EAGLE - PICHER (Picher) — Moved boarding house to allow sinking of third shaft for Crawfish mill.

HIDDEN TREASURE (Picher)—Planning erection 350-ton mill. Colin S. Campbell, of Oklahoma City, is president. John Grifford, of Baxter, is manager.

MANHATTAN (Picher)—Leased to John Skinner and associates, who will operate.

ROYAL (Picher)—Operating after being down several weeks for overhauling.

ALAMO LEAD AND ZINC (Quapaw)—To build 200-ton mill and expect to purchase tables, engine, compressors, crushers and ore cars. Joe T. Burger, Dallas, Tex., is superintendent.

CHARLOTTE (Quapaw)—Purchased mill at Granby and will move it to lease near old Red Eagle mine, at Lincolnville.

DORRIS (Quapaw)—New 250-ton mill in operation.

SAMBO (Quapaw)—Purchased by Chas. H. and William S. East, of Lima, Ohio, and Walter Peltier, of Miami. Mill being overhauled.

HUTTIG LEAD AND ZINC (St. Louis)—To build 200-ton mill and will purchase compressors, crushers, tables, engine and boilers. R. M. Simrall is superintendent.

HEALDTON (Tar River)—Sinking shaft and expect to build mill.

OREGON

Douglas County

E. B. CRANE (Cottage Grove)—Taken over the Buena Vista group of quicksilver mines, situated near the Douglas-Jackson county line, and owned by W. S. Webb, of Gold Hill.

Jackson County

LITTLE JEAN (Gold Hill)—Lease on cinnabar mine taken by Toney Ross. Property equipped with 12-pipe mercury furnace and has been a producer since 1878.

Josephine County

AMERICAN EXPLORATION & DEVELOPMENT (Grants Pass)—Unwatering old Tyson chrome mine on Chrome hill, near Smith River. This is the oldest chrome mine on the continent and was worked in the early 70's, but abandoned in 1875.

UTAH

Juab County

VICTORIA (Eureka)—Portion of the mine to be operated by lessees.

Salt Lake County

SELLS (Alta)—Expect to place tramway in operation September 1.

Tooele County

GOLD HILL (Gold Hill)—Making regular shipments of lead-silver ore. Shaft retimbered and will be sunk to 500 level.

SOUTHERN CONFEDERATE (Gold Hill)—To install hoist at shaft and resume sinking. W. C. Davis is superintendent.

WESTERN UTAH EXTENSION (Gold Hill)—Mining on 200 and 300 levels of Mogul shaft. Winze in Helmet tunnel to be sunk 100 ft. in vein.

YELLOWHAMMER (Gold Hill) — Improvements completed and mining resumed.

WASHINGTON

Stevens County

NORTHWEST MAGNESITE (Chewelah) —Produced 4000 tons of calcined magnesite during July. Four kilns are in service and two more are to be added.

SPOKANE COPPER (Loon Lake)—To resume operations. To crosscut from bottom of 110-ft. shaft.

CANADA

British Columbia

SILVERSMITH (Sandon)—Opened large orebody. Will increase force if possible.

Ontario

APEX (Porcupine)—Mining plant has been sold.

SANDY FALLS (Porcupine) — Power plant on Mattagami river has been closed Decreased calls for power in Porcupine can be met by the Waweatin plant.

THOMPSON KRIST (Porcupine) — Has not been able to make arrangements with Vipond to continue work from 400 level of latter company's property.

COBALT SHIPMENTS for the week ended Aug. 10 were: McKinley-Darragh, 144,348 lb.; Nipissing, 81,250 Dominion Red, 78,000; Trethewey, 77,165 and Coniagas, 58,318 lb. The shipments aggregated less than 220 tons.

COCHRANE (Cobalt)—Has been leased by the Temiskaming, which will develop.

KERR LAKE (Cobalt)—July production was 231,000 ounces. For year ended July 31 production was 2,359,229 ounces.

MINING CORPORATION (Cobalt)—Has dropped option on group of claims at Fort Matachewan and has sold plant and supplies to the Nipissing, which will develop property adjoining the Otisse.

NIPISSING (Cobalt) — High-grade mill has been closed, as company finds it can treat high-grade and concentrates in the low-grade mill and effect a considerable saving.

PETERSON LAKE SILVER COBALT (Cobalt)—Has completed 100-ton mill. J. W. Hosking is superintendent.

PROVINCIAL (Cobalt)—Has been closed down, but is expected to reopen in the fall.

WALDMAN (Cobalt) — Operations on property, which is under option to the Mining Corporation of Canada, have been discontinued.

KEELEY (South Lorraine)—To resume operations in charge of Malcolm Black. West of Wettlaufer mine and developed by several shafts.

PITTSBURGH LORRAINE (South Lorraine)—Has leased Wettlaufer mill and mine and is carrying on exploration work. R. T. Strong is manager.

LAKE SHORE (Kirkland Lake)—Treated 1761 tons of ore, averaging $24.61 and received $43,353 in June. Most of the ore came from development.

ONTARIO-COLORADO (Matachewan)—Diamond drilling of this property, formerly the Otisse, is meeting with favorable results.

OTISSE (Fort Matachewan)—Four diamond drill holes have been put down and drilling is being continued.

SULLIVAN (Matachewan) — Surface samples show high grade gold content.

McIVOR CLAIMS (Beatrice Lake)—Small mining plant has been installed.

MILLER INDEPENDENCE (Boston Creek)—Sinking has been resumed. To sink shaft to 200 level and drift east and west.

RENAUD CLAIMS (Boston Creek)—Has been taken over by Robert Norrington, representing Detroit interests.

CORDOVA (Cordova Mines)—Electric plant to produce ferrochrome. Crude ore obtained from Quebec. P. Kirkegaard is in charge.

HOWIE-COCHENER (Lightning River) —Installed plant and will resume shaft sinking.

PERU

Junin

CERRO DE PASCO (Cerro de Pasco)—July production was 2619 tons of blister copper.

ASIA

Chosen

ORIENTAL CONSOLIDATED (Unsan) —July cleanings, $111,000. June tonnage milled aggregated 25,289 tons.

The Market Report

SILVER AND STERLING EXCHANGE

Aug.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Aug.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
15	4.7600	99⅛	48 11/16	19	4.7550	101⅛	48 11/16
16	4.7600	99⅛	48 11/16	20	4.7550	101⅛	48 11/16
17	4.7600	99⅛	48 11/16	21	4.7550	101⅛	49⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
15	*26	†	8.05	7.75	8⅛ @8⅜
16	*26	†	8.05	7.75	8.70 @8.80
17	*26	†	8.05	7.75	8.70 @8.80
19	*26	†	8.05	7.75	8.75 @8.85
20	*26	†	8.05	7.75	8⅞ @9
21	*26	†	8.05	7.75	9 @9⅛

*Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917, and July 2, 1918.

† No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

Aug.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
15	122	122	137	385½	385½	29½	28⅝	54
16	122	122	137	385½	385½	29½	28⅝	54
17	...	...	...	...	...	...	...	...
19	122	122	137	381½	381½	29½	28⅝	54
20	122	122	137	377½	377½	29½	28⅝	54
21	122	122	137	375½	375½	29½	28⅝	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515: £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—Aug. 21, 1918

The main features of interest in the metal markets this week were the advances in the prices of zinc and silver, the continuation of the easiness in tin, and more acuteness in the stringency in lead.

Copper—There was nothing of special interest to report.

The copper selling contract between the Granby Consolidated Mining, Smelting and Power Co. and the American Metal Co. will soon expire and will not be renewed.

The United Verde Copper Co. has taken over the sale of its own copper, which heretofore has been sold by L. Vogelstein & Company.

Copper Sheets—Situation unchanged; prices not quoted. Copper wire is quoted at 29 to 30c. per lb. f.o.b. mill, carload lots, subject to any change in the price of copper. Unchanged

Tin—The recent large arrivals of tin, together with reluctance on the part of buyers, have produced a decidedly easier situation in this metal. Even some lots of Straits tin have turned up in the market, one or two sales at 90c. being reported. However, this kind of tin is earmarked for Governmental purposes and is subject to allocation; wherefore there is no general market in it. Banka tin and 99% grades have sold at 88c. However, shipments of Banka cannot be contracted in Batavia for less than $1. The East is very firm, and local dealers look for higher prices again in this market.

Singapore quoted £381½, c.i.f., London, on the 15th; £383½ on the 16th; £379½ on the 19th; £377½ on the 20th; and £375½ on the 21st.

Lead—The situation remains unchanged. August lead is no longer to be had, and practically the same can be said of September supply. Anyhow, the latter is very scarce indeed. The production of domestic lead in the first semester of 1918 was 266,874 tons, not including antimonial. This figure is to be compared with 563,000 for the whole of 1917, and 570,000 tons in 1916; wherefore it is evident that there has been a serious decline in production, which is the root of the present trouble. The present effort is to reduce non-essential consumption still further.

Under date of Aug. 20, the following notice was sent out by Clinton H. Crane, chairman of the Lead Producers' Committee: "The demand for pig lead for use on vital war work is now so acute that all possible conservation of the existing supply has become imperative. The Lead Producers' Committee for War Service earnestly requests the coöperation to this end of every manufacturer and dealer. All are asked to endeavor to eliminate non-essential uses of lead in order that there may be more available for direct and indirect United States Government orders and for other work of national importance. It is necessary that all consumers and jobbers refrain from accumulating any stocks except such as will allow a reasonable working margin. No pig lead whatsoever will be sold by producers for re-sale in carload lots. Re-melted or scrap lead is not to be sold at higher prices than the current market for virgin lead. Retail dealers may be supplied solely on the basis of their agreement to re-sell only to customers whose requirements appear to be essential, and also to limit the price charged to ½c. per lb. in excess of the ruling wholesale price."

By a typographical error the quotation for 3 months lead in London on Aug. 12 was given at £29½ instead of £28½, the latter being the correct figure.

Zinc—This market advanced rather rapidly on only a moderate volume of business. The reasons for the advance are rather mysterious. The weekly statistics that are now being published have been favorable, and without reflecting any fundamental change they have undoubtedly created a more optimistic sentiment. Some recent buying for export to Japan has probably had an effect also. We are inclined to think, however, that some domestic manufacturers who have failed to cover their requirements for the remainder of this year have overstayed their market too long. On the 19th spelter sold at 8.75c. in the early part of the day, while in the latter part, 8.85c. was realized for a round lot, with buyers over. On the 20th 9c. was realized, and on the 21st there were sales in the morning at 9c., and in the afternoon, at 9⅛c., with buyers over.

The sheet zinc producers met the War Industries Board on Aug. 21 and discussed price, with the result of an agreement to maintain the existing prices. The producers proved substantial increases in cost of production, but made no request for higher prices. The producers of high-grade and refined zinc are to meet the War Industries Board on Aug. 22. In their case an awkward situation develops, for with common spelter at 9c., high-grade will have to be higher than 12c., else refining by redistillation will cease, a margin of 3½c. being reckoned necessary for that purpose.

Zinc Sheets—Unchanged at $15 per 100 lb., less usual trade discounts and extras as per list of Feb. 4. Unchanged.

Aluminum—Price fixed at 33c. per lb. for lots of 50 tons or more, ingot, 98-99% grade. Sheets are 42c. per lb. for 18 gage and heavier. Price established June 1 and continues to Sept. 1. Unchanged.

Antimony—Strength in this market continued. There were some Governmental inquiries here, and Japan was reported again to be a buyer in China. The course of the market in the near future will depend a good deal upon the situation as to the stock. It is the common opinion that the latter has been much reduced. We quote spot at 14¼@14½c. We quote futures at 13¼@13½c., c.i.f., in bond.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—This metal is quoted $1.50@1.75 per pound. Unchanged.

Nickel—Market quotation: Ingot, 40c.; shot 43c.; electrolytic 45c. per lb. Unchanged.

Quicksilver—Unchanged at $125. San Francisco reports by telegraph, $117.50, steady.

Gold, Silver and Platinum

Gold and Silver Shipments—According to a report from the United States Sub-Treasury, gold coin amounting to $205,000 has been withdrawn for shipment to Mexico. In addition, it was announced that $1,000,000 in silver had been withdrawn from the assay office for shipment to India. This is presumably a part of the silver melted from silver dollars by the Treasury Department, 100,000,000 of these coins having been melted within the last three months to provide silver for shipment to China, Japan and India.

Silver—The Treasury Department issued a ruling on Aug. 15, 1918, defining the future policy of the Government with respect to silver exportations, and the order was published in the press throughout the country as follows:

"Under the authority of the act of Congress approved Apr. 23, 1918, silver has been sold by the Secretary of the Treasury at a price which will permit the Treasury, from new purchases of a corresponding amount of silver at the price of $1 per fine oz., to recoin the silver purchased into silver dollars without loss. In order to provide for the various items of expense involved, it was found necessary to fix the price for which silver was sold at $1.01¼ per fine oz., and it was made a condition of sale that the purchaser should not pay a higher price for silver in other markets than in those of the United States. Up to the present time the Federal Reserve Board has freely granted licenses for the export of silver. In order, however, to conserve the use of silver, export licenses for silver will hereafter be granted only for civil or military purposes of importance in connection with the prosecution of the war, and only in cases where the exporter certifies that the silver to be exported has been purchased at a price which does not directly or indirectly exceed $1.01¼ per oz. 1000 fine, at the point where silver is refined in the case of silver refined in the United States or at the point of importation in the case of imported silver. Applications for licenses to export silver should also state from whom the silver was purchased, the point at which silver was delivered to purchaser, for whose account and by whose order and for what purpose the silver is to be exported."

This ruling in effect establishes a maximum price of $1.01¼ per oz. 1000 fine, and the silver price will hold at this figure so

long as the demand for export exceeds the supply. Our Government will consequently be unable to purchase silver at $1 per fine oz. until this law of supply and demand operates to bring the price of silver in the open market down to that figure.

The British Treasury has raised its maximum price to 49½d. to conform to maximum price in the United States. The New York official price has been fixed at $1.01⅛ per oz., 999 fine.

Mexican dollars at New York: Aug. 15, 77; Aug. 16, 77; Aug. 17, 77; Aug. 19, 78; Aug. 20, 78; Aug. 21, 78.

Platinum, Palladium and Iridium—Prices fixed at $105, $135 and $175, respectively.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 17—Blende, per ton, high, $77.20; basis 60% zinc, premium, $75; Class B, $65@60; Prime Western, $52.50@50; calamine, basis 40% zinc, $37.50@30. Average selling prices: blende, $55.10; calamine, $36.83; all zinc ores, $54.65.

Lead, high, $102.70; basis 80% lead, $100; average selling price, all grades of lead ore, $100.26 per ton.

Shipments the week: Blende, 10,835; calamine, 278; lead, 1522 tons. Value, all ores the week, $760,650.

The closing strength of last week was manifested in a $5 advance on purchases this week, and this week closes even firmer, with all buyers in the market with larger orders to fill, and sellers today declining to sell until next week's market. For awhile yesterday there was a lull, then heavier orders came to the buyers and the sellers stiffened and then declined to sell.

Platteville, Wis., Aug. 17—Blende, basis 60% zinc, $75 for premium grade. Highest settlement price reported was $74 per ton. High-lead blende, base $47.50. Lead ore, basis 80% lead, $93 to $95 per ton. Shipments reported for the week were 2614 tons blende, 303 tons galena and 598 tons sulphur ore. For the year to date, the totals are 82,281 tons blende, 4809 tons galena and 31,817 tons sulphur ore. During the week 2325 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—Offerings from the West are more liberal, especially of the lower grades, and prices are a shade easier.

Manganese Ore—Unchanged.

Molybdenum Ore—Unchanged, with buyers conspicuous by their absence.

Tungsten—The market continues very active in high-grade ores, and high-grade scheelite is difficult to obtain at the prices quoted, $25.50 per unit. The highest grade wolframite realized $24.50; lower grade wolframite, high in tungstic-acid content, sold for $24; wolframite with a slight percentage of impurities sold for $23. Impure scheelites are hard to market; impure wolframites are quoted at $18 to $20 per unit.

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight; but no sulphur imports are being received. Domestic pyrites is selling at a price of 25c. per unit, f.o.b. mine, according to delivery basis. Some mines in the South are reporting prices as 34c. per unit for lump and 32c. per unit for fines f.o.b. mines. Unchanged.

Iron Trade Review

PITTSBURGH—Aug. 20

The weather has been favorable in the past few days from the production standpoint, and furnaces and mills are beginning to look for record-breaking outputs within a few weeks. Curtailment in output from weather conditions this season has been unprecedentedly small. On account of various troubles from time to time, chiefly coke shortage, output has at no time been at rated capacity since late in 1916. Record rates of actual production may be reached without capacity operation being attained, because there has been much increase in capacity. Causes of output being at less than capacity are being carefully studied. There is now relatively little actual shortage of coke, but considerable complaint remains as to quality. Because of poor grade, coke consumption per ton of pig iron produced is too high, and there is some restriction in the actual output. In some quarters it is claimed that too many furnaces are on ferromanganese and spiegeleisen, which afford greater profits than pig iron, and that the authorities are likely to order some furnaces back to pig iron, which is scarcer than the manganese alloys. As to steel mill outputs, the greater restrictive influence is shortage of scrap, particularly shortage of the better grades, and this, of course, cannot be remedied.

The testimony of department representatives before Congressional committees in connection with the draft law, that the war can be won in 1919, gave the steel industry no new view, as that idea has been entertained for several weeks at least, and is no doubt based upon the magnitude of the preparations, with which the trade is familiar, though there has always been a ban upon the giving out of details. As to steel consumption, additional information is made available through the official announcement within the week that the warehouses built and being built in the United States by the Construction Division of the Army total $218,000,000 in cost and involve 33,800,000 sq. ft., and are made almost entirely of concrete, brick and steel.

With only moderately favorable conditions, the production of finished rolled steel in the present half year should be about 18,000,000 net tons, taking account of the summer curtailment, and a rate of 40,000,000 net tons a year is distinctly possible for the future, and some new construction is under consideration.

Pig Iron—The shortage of pig iron has grown more pronounced and is variously ascribed to a combination of causes, poor quality of coke, shortage of coke, indifference of labor at some furnaces, too much blast-furnace capacity on ferromanganese and spiegeleisen—19 furnaces at last count—shortage of scrap, requiring openhearth furnaces to use more pig iron than normal, and the heavy demands of Great Britain, France and Italy. Selling for first half 1919 has practically stopped, partly because furnaces are not certain that they will be able to deliver after direct orders and allocations are met and partly because the War Industries Board does not seem to favor operation. Allocations for early deliveries continue heavy. Some steel mills that have always got their pig iron from the same source under long-term contracts have had to depend largely upon allocations, as the iron they usually get is still more useful in some other connection. There are practically no open-market transactions. Allocations represent forced orders at the set prices, which remain: Bessemer, $35.20; basic, $32; foundry, $33; malleable, $33.50; forge, $32; f.o.b. furnace, freight from Valleys to Pittsburgh being $1.40 and from six detached furnaces somewhat less.

Steel—Substantially all the soft steel in unfinished form is already moving in approved channels, leaving nothing new to be sold in the market or to be allocated. Prices remain: Billets, $47.50; sheet bars and small billets, $51; slabs, $50; rods, $57. Only occasional small lots of shell-discard steel come out, and any that can possibly be graded as forging is sold under that category.

Ferroalloys—Ferromanganese was recently in poorer supply, but there is no difficulty at present, and, as noted above, some observers think too much is being produced and that some furnace capacity should be diverted to pig iron, which is more urgently needed. On the whole, domestic ores have not proved as good as expected, being too lean, and more Brazilian ore will have to be imported than was counted upon, but the authorities will take care of this. The recent recommendation that large consumers cover for the first half of 1919 is interpreted to mean that the price, although not formally fixed, as in pig-iron and steel products, will continue, and that ore will be provided at a fair cost. The market is only moderately active, despite the recommendation as to buying for first half of 1919. Some large consumers are already covered, though others have not yet begun to buy. The market remains at $250, delivered, for 70% ferromanganese, with $4 a unit for higher manganese content, and at $75, furnace, for 16% spiegeleisen.

Coke—As byproduct-coke production increased during the second quarter of the year, through the completion of more capacity, the beehive production seemed in a fair way to continue, but in the last few weeks beehive production has decreased almost as much as byproduct has increased, the coal for the new byproduct ovens having to be taken from beehive ovens to large extent. Generally speaking, the country's output is now running at a trifle above 600,000 net tons a week beehive and a trifle above 525,000 net tons byproduct, with prospects that byproduct will pass beehive in from two to four months. It was in the first week in July that byproduct production first crossed the 500,000-ton mark.

STOCK QUOTATIONS

N. Y. EXCH.†	Aug. 20
Alaska Gold M.	3⅛
Alaska Juneau	2
Am.Sm.& Ref.,com.	78½
Am. Sm. & Ref., pf.	104
Am. Sm. Sec., pf., A	90½
Am. Zinc	18
Am. Zinc, pf.	‡49½
Anaconda	65½
Batopilas Min	1
Bethlehem Steel	83
Butte & Superior	25⅛
Butte Cop. & Zinc	11⅛
Cerro de Pasco	35
Chile Cop.	16⅛
Chino	38⅛
Colo.Fuel & Iron	47
Crucible Steel	68⅛
Crucible Steel, pf.	90
Dome Mines	8½
Federal M. & S.	12
Federal M. & S., pf.	35
Great Nor., ore ctf.	31⅞
Greene Cananea	44⅛
Gulf States Steel	83½
Homestake	72
Inspiration Con.	51⅜
InternationalNickel	29⅞
Kennecott	33⅜
Lackawanna Steel	83
Mexican Petrol	101
Miami Copper	27⅞
Nat'l Lead, com.	59½
National Lead, pf.	103½
Nev. Consol.	20
Ontario Min	9¾
Ray Con	24
Republic I.&S.,com.	91
Republic I. & S., pf.	101
Sloss-Sheffield	59⅞
Tennessee C. & C.	19½
U. S. Steel, com.	111½
U. S. Steel, pf.	110⅜
Utah Copper	80⅛
Va. Iron C. & C.	73

BOSTON CURB*	Aug. 19
Alaska Mines Corp.	.12
Boston Ely	.60
Boston & Mont.	.51
Butte & Lon'n Dev.	.15
Calaveras	1
Chief Con.	2½
Contact	.15
Corbin	10
Cortes	.07½
Crown Reserve	.18
Crystal Cop.	.38
Eagle & Blue Bell	2⅛
Houghton Copper	.50
Intermountain	‡.05
Iron Cap	19½
Mexican Metals	.45
Mines of America	1
Mojave Tungsten	.09
Nat. Zinc & Lead	.16
Nevada-Douglas	.52
New Baltic	.90
New Cornelia	18
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	.07
Yukon Gold	1

SAN FRAN.*	Aug. 20
Alta	.03
Andes	.05
Best & Belcher	.02
Caledonia	.04
Challenge Con.	.03
Confidence	.06
Con. Virginia	.22
Gould & Curry	.01
Hale & Norcross	.02
Jacket-Cr. Pt.	.07
Mexican	.17
Occidental	‡.51
Ophir	.05
Overman	.02
Savage	.03
Sierra Nevada	.03
Union Con.	.40
Utah Con.	.01
Belmont	2.50
Jim Butler	.55
MacNamara	.31
Midway	.04
Mont.-Tonopah	.09
North Star	.06
Rescue Eula	.12
West End Con.	1.05
Atlanta	.03
Booth	.04
Comb. Frac.	‡.02
Florence	.11
Jumbo Extension	.10
Kewanaa	.03
Midway	.03
Nevada Hills	.27
Nevada Packard	.18
Round Mountain	.05
Silver Pick	.24
White Caps	‡.75
Big Jim	3.25
United Eastern	

COLO. SPRINGS*	Aug. 20
Cresson Con.	4.81⅛
Doctor Jack Pot	.03½
Elkton Con.	.04½
El Paso	.10
Gold Sovereign	‡.02
Golden Cycle	1.69½
Granite	.17
Isabella	.04½
Mary McKinney	.07½
Portland	.80
United Gold M.	.13
Vindicator	.40

BOSTON EXCH.*	Aug. 20
Adventure	.60
Ahmeek	75½
Algomah	‡.15
Allouez	.49
Ariz. Com., ctfs.	15
Arnold	.20
Bingham Mines	9½
Bonanza	.16
Butte-Balaklava	.25
Calumet & Ariz.	67½
Calumet & Hecla	460
Centennial	12
Copper Range	48
Daly West	2½
Davis-Daly	5½
East Butte	9½
Franklin	3½
Granby	70
Hancock	6
Hedley	‡12
Helvetia	.15
Indiana	.50
Isle Royale	25½
Keweenaw	.87
Lake	5
La Salle	2½
Mason Valley	3½
Mass	4½
Mayflower	2½
Michigan	2½
Mohawk	55
New Arcadian	1½
New Idria	13
North Butte	14½
North Lake	.60
Ojibway	.65
Old Dominion	39½
Osceola	50½
Quincy	69½
St. Mary's M. L.	50
Santa Fe	.60
Seneca	11
Shannon	3½
Shattuck-Ariz.	15½
So. Lake	1
So. Utah	.16
Superior	4½
Superior & Bost.	1½
Trinity	3
Tuolumne	1½
U. S. Smelting	41½
U. S. Smelt'g, pf.	42½
Utah Apex	1½
Utah Con.	9½
Utah Metal	2⅛
Victoria	9
Winona	1½
Wolverine	22
Wyandot	.50

N. Y. CURB†	Aug. 20
Big Ledge	¼
Butte & N. Y.	‡.75
Butte Detroit	.15
Caledonia	.46
Calumet & Jerome	¼
Can. Cop. Corpn.	1¼
Carlisle	‡2
Cashboy	.05
Con. Ariz. Sm.	1½
Con. Coppermines	5
Con. Nev.-Utah	⅛
Emma Con.	‡.10
First Nat. Cop.	1¼
Goldfield Con.	.22
Goldfield Merger	‡.03
Greenmonster	⅛
Hecla Min	5⅛
Howe Sound	4½
Jerome Verde	.50
Louisiana	⅛
Magma	.30
Majestic	.18
Marsh	‡.04
McKinley-Dar-Sa.	.43
Milford	‡.75
Mother Lode	.35
Nixon Nevada	.48
Ohio Cop.	‡1⅛
Rawley	‡2½
Ray Hercules	4½
Richmond	‡.56
Rochester Mines	.35
St. Joseph Lead	14½
Standard S. L.	‡½
Stewart	.13
Success	‡.12
Tonopah	2½
Tonopah Ex.	1½
Tribullion	‡⅛
Troy Arizona	.12
United Cop.	‡⅛
United Verde Ext.	37
United Zinc	‡1½
Utica Mines	‡.08

TORONTO*	Aug. 1
Adanac	‡.06
Bailey	.02
Beaver Con	.20
Chambers Ferland	.12
Coniagas	2.50
Hargraves	.04
Kerr Lake	5.62½
La Rose	.25
Min. Corp. of Can.	2.00
Nipissing	8.37½
Peterson Lake	.08
Temiskaming	.28
Wettlaufer-Lor.	.03
Davidson	‡.25
Dome Exten.	.12
Dome Lake	.10
Hollinger	4.25
McIntyre	1.25
Newray	.56½
Porcu. Crown	.10
Teck-Hughes	.14
Vipond	.10
West Dome	.08

* Bid prices. † Closing prices. ‡ Last Quotations.